RANGE SITES AND SOILS OF THE KOTZEBUE SOUND AREA

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by

James E. Preston, William R. Fibich, Thomas H. George and Peter C. Scorup[1]/

P R E F A C E

The Kotzebue Sound range and soil survey report provides information that can be used by range managers, land use planners, engineers, contractors, and others who are concerned with wise use of the land. It will help reindeer herders, and others associated with the reindeer industry, to determine amount of forage available, best season of use, location of the range resources, and soil conditions which may affect the movement and health of the reindeer. It will assist in selecting sites for building roads, houses, and other structures.

In making this survey range and soil scientists examined and described the vegetative communities and soils of the area and prepared maps showing their distribution. Range sites were correlated with soils whose boundaries are delineated. A distinctive map symbol identifies each kind of site.

Imagery from LANDSAT, the Earth Resources Technology Satellite of the National Aeronautical and Space Agency, was extremely useful in the survey. Through the use of digitally processed LANDSAT data, limits of vegetative types in the area were defined much more accurately and quickly than would have been possible by field observation alone. Satellite data is acquired by recording the intensity of electromagnetic energy reflected from the surface of the earth. This information is telemetered to the earth and stored on video tape from which images and computer tapes are processed.

Reindeer herders and range planners interested in a particular area of land should first locate that area on the Range Sites and Soils Map, and then identify the range sites and soils in it. They will find descriptions in the section, Range Sites and Soils. This section also discusses good range management practices and the suitability of soils for the production of range. Range suitability maps for reindeer, moose, and muskox are bound with this report.

1/ James E. Preston is State Range Conservationist, and William R. Fibich is Assistant State Soil Scientist for USDA Soil Conservation Service, Alaska. Thomas H. George is a Satellite Applications Specialist, Geophysical Institute, and Peter C. Scorup is an Agronomy Technician, Alaska Agricultural Experiment Station, University of Alaska. Issued December, 1977.

Engineers and others concerned with construction will find general information on the physical characteristics of the soils in the section, Engineering Uses of Soils. Classification of the soils is discussed briefly in a section intended primarily for soil scientists.

The maps in this report are at a scale of 1:250,000 (approximately 4 miles = 1 inch). In addition, the survey area has been mapped at 1:63,360 (1 mile = 1 inch) in much more detail. These larger scale maps may be viewed at the Soil Conservation Service State Office in Anchorage.

Field work for this survey was completed in 1976, and all statements in the report refer to conditions at that time. The range and soil survey is part of the technical assistance furnished by the Soil Conservation Service to the Alaska Soil Conservation District. The survey was financed in part by the Northwest Alaska Native Association (NANA), the University of Alaska Geophysical Institute, the Alaska Agricultural Experiment Station, the Bureau of Land Management, the Bureau of Indian Affairs, and the State of Alaska, Department of Natural Resources, Division of Agriculture.

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TABLE OF CONTENTS

TABLE OF CONTENTS
(Continued)

TABLES

MAPS

GENERAL DESCRIPTION OF THE AREA

The Kotzebue Sound Range and Soil Survey Area contains about 7,087 square miles. It is roughly rectangular in shape and is approximately 120 miles east to west and 60 miles north to south. It extends from the Continental Divide on the Seward Peninsula north to Kotzebue Sound, and includes the Baldwin Peninsula. It is bordered on the west by the Pish River and on the east by 160 degrees west longitude. Elevations range from sea level to 3307 feet on the Selawik Hills in the northeast part of the area. Micaceous schist, limestone, and marble bedrock underlie much of the area drained by the Goodhope, Inmachuk, Kiwalik, and Kugruk Rivers and extend to Clem and Granite Mountains on the east. In the eastern third of the area, which is drained by the Buckland and the Kauk Rivers, the underlying bedrock is basalt, granite, and sandstone. Silty materials ranging in depth from a few inches to 20 feet cover much of the area. Deep deposits are most extensive in the northwest part but occur in saddles, valleys, and footslopes throughout the region. Most of the soils have a peaty surface mat that ranges in thickness from a few to 16 inches over the mineral soil; about 5 percent are organic soils. Continuous permafrost underlies the area, except in alluvial sandy and gravelly sediments adjacent to the rivers and on the beaches bordering Kotzebue Sound.

Thaw lakes and drained lake beds occur in the deep silty deposits; a distinctly polygonal ground pattern has developed in the old lake beds. Stone rings and stone stripes occur on and near the hilltops, where bedrock is close to the surface. Solifluction lobes occur on the lower slopes.

The vegetative cover is related to soil materials, drainage, aspect, and slope. In areas of deep silty materials the most common plants are low-growing shrubs and tussock-forming sedges. On the peaty soils in depressions, the dominant plants are sphagnum moss and sedges, but low-growing shrubs and lichens occupy high points of polygons. Hilltops with shallow soils over bedrock are covered with dryas, lichens, sedges, horsetail, bearberry, blueberry, and other low-growing tundra plants. Some high knolls are almost barren. The flood plains bordering the rivers support a growth of shrubby willows, alder, dwarf birch, grasses, and horsetail. A few scattered groves of spindly cottonwood occur. White spruce grows along rivers and on hills in the southeastern part of the area.

INDUSTRY AND HUSBANDRY

Deering was established in 1901 as a supply station for the mining camps in the interior of the Seward Peninsula. It was probably named for the 90-ton schooner "Abbie Deering" which was in nearby waters about 1900 (5) [1]. Many of the buildings in the village are now abandoned, however,

[1] Numbers in parentheses refer to Literature Cited.

and the population is only about 95. Facilities include a school, trading post, and church. A few small gold mines in the area furnish seasonal employment. Sea and land animals are taken for food and fur. Reindeer husbandry provides a large part of the livelihood for these people.

The City of Kotzebue was named after Otto von Kotzebue, in command of a Russian expedition in search of the northwest passage in 1816 (4). It serves as the education, supply, and transportation center for the villages of the region. Kotzebue has a population of 2200. Facilities include telephone, telegraph, a hospital, churches, hotels, and stores. Fishing and tourism are sources of seasonal income for many of the people of the city. Kotzebue is famed for its jade and ivory carvings as well as hand made mukluks, parkas, and other items of Eskimo culture. The NANA Corporation has its main office in this city.

Buckland is a village and trading post on the Buckland River about 18 miles south of Eschscholtz Bay. The Buckland post office was established in 1935. Population is about 140 (5). Subsistence hunting and reindeer husbandry supplies much of their livelihood.

Reindeer herding in Western Alaska has a long and colorful history. Reindeer were first introduced from Siberia in the 1890's as a part of a federal project to provide a source of meat, clothing, and transportation for Alaskan Eskimos. For some time the industry flourished, and at its peak in the 1930's there were estimated to be over half a million reindeer in the Territory of Alaska. A sharp decline followed, brought on in part by a change in federal policies, bad weather, overgrazing, and poor market conditions. By 1950 the number of reindeer remaining in domestic herds had declined to approximately 25,000 (1).

Muskox, once native to Alaska's arctic slope, were extirpated from Alaska in the latter half of the nineteenth century. The species was reestablished in the State in 1935 and 1936, when thirty-one Greenland muskox were introduced to Nunivak Island, a National Wildlife Refuge. Following slow initial increases, the population soon achieved a substantial growth rate, growing to more than 600 animals by 1966. Among the objectives of the Nunivak introduction were the possibilities of future transplants to former Alaskan ranges (3). Muskox sightings on the Seward Peninsula are reported by Eskimo reindeer herders.

Moose were either scarce or absent in the subregion until 50-75 years ago (1). About 30 moose were observed during the four week survey period (primarily in the Brushy Drainages Range Site).

CLIMATE

The area has a cold maritime climate. The mean July and August temperature is about 50° F. Summers are typically cool and moist, and low overcast and drizzle are common. The average freeze-free season is just short of 90 days.

Table 1. Mean monthly temperatures, precipitation, and inches of snowfall, Kotzebue, Alaska. (31 year record through 1973)*

	J	F	M	A	M	J	J	A	S	O	N	D	Ann.
Temperatures, °F.													
Max.	2.4	2.1	7.3	21.5	37.8	49.6	58.7	55.5	46.2	28.4	13.5	3.1	27.2
Min.	-11.4	-12.9	-10.0	2.6	23.7	37.5	47.5	45.5	35.8	18.5	2.3	-9.6	14.1
Mean	-4.5	-5.4	-1.4	12.1	30.8	43.6	53.1	50.5	41.0	23.5	7.9	-3.3	20.7
Precipitation, inches of moisture													Sum
	.35	.29	.33	.32	.39	.52	1.56	2.29	1.39	.63	.43	.35	8.85
Snowfall in inches													
	5.4	4.8	5.4	3.5	1.0	.1	T	T	1.1	5.4	7.5	6.3	40.5

* Data from U.S. Weather Bureau, Anchorage, Alaska.

In winter, sea ice tends to mask the moderating influence of the sea. This effect, plus the short winter days, results in cold temperatures characteristic of areas farther inland. Southwesterly winds have brought maximum temperature readings in the middle 30s during winter. Minimum temperatures average about -10° F. to -13° F. from December through March. In general, winters are cold and relatively dry with much clear weather, but with prolonged periods of blowing and drifting snow (10).

Mean monthly temperature, precipitation, and snowfall for Kotzebue are given in Table 1.

HOW SOILS ARE MAPPED AND CLASSIFIED

Soil scientists made this survey to learn what kinds of soils are in the Kotzebue Sound Area, where they are located, and how they can be used. As they traveled over the area, they observed physiography of the land, size and speed of streams, kinds of native plants, kinds of rock, and facts about the soils. They dug many holes to expose soil profiles. Access was by helicopter and on foot.

In the process of making this survey, the use of digitally processed satellite imagery contributed mostly by showing the locations, patterns, and size of the various plant communities and their associated soils. A color-patterned image or base map was the result. The next step was to investigate the various colors.

This investigation includes the complete inventory and classification of the principal plants and soils within the individual colors. A strong correlation was proven between color on the image and kinds of plants and soils within the area of that color.

A soil profile is the sequence of natural layers or horizons from the soil surface down to the underlying material which has not been altered by weathering or plant roots. Soils that have broad similarities in kind, arrangement, and degree of expression of horizons, and in soil moisture and temperature regimes, make up a soil great group. The great group is further subdivided into soil subgroups.

Soils in mapping units of the Kotzebue Sound Area are classified as soil subgroups, miscellaneous areas, or associations of subgroups and/or miscellaneous areas. Miscellaneous areas are not composed of soil and consist of stones, boulders, lava rock, and sand and gravel bars near streams; these areas are not vegetated. Each mapping unit also includes areas of other soils that are too small to delineate separately.

RANGE SITES AND SOILS

Rangeland is land on which the native vegetation (climax or natural potential plant community) is predominately shrubs, grasslike plants,

Table 2. Acreage and Proportionate Extent of Range Sites and Soils of the Kotzebue Sound Area, Alaska.

Range Sites and Soils	Map Symbol	Approx. Area (acres)	Proportionate Extent, %
ACID ROCK DESERT (Rubble land - Pergelic Cryumbrepts Association)	IU1	50,100	1
ALKALINE ROCK DESERT (Pergelic Cryoborolls)	MB	71,100	2
ALLUVIAL MIXED FOREST (Pergelic Cryorthents)	EO	75,900	2
ALLUVIAL TALL SHRUB (Pergelic Cryaquepts)	IQ7	79,900	2
BRUSHY DRAINAGES (Pergelic Cryaquepts)	IQ6	227,300	5
DRAINED LAKE BORDERS (Pergelic Cryofibrists-Histic Pergelic Cryaquepts Association)	HF2	198,500	4
DRAINED LAKES (Pergelic Cryofibrists)	HF1	42,200	1
LAVA BEDS (Lava Flows - Entisols Association)	LF	63,400	1
LOW SHRUB TUSSOCK TUNDRA (Histic Pergelic Cryaquepts)	IQ2	1,741,600	38
MIXED SHRUB TUSSOCK TUNDRA (Histic Pergelic Cryaquepts)	IQ4	983,980	22
SPARSE SHRUB TUSSOCK TUNDRA (Histic Pergelic Cryaquepts)	IQ3	311,800	7
TIDAL MARSH (Histic Pergelic Cryaquepts)	IQ1	55,400	1
UPLAND MOUNTAIN MEADOW (Pergelic Cryaquepts)	IQ5	501,700	11
UPLAND WHITE SPRUCE (Pergelic Cryumbrepts - Pergelic Cryoborolls Association)	IU2	108,200	2
Land Area		4,511,080	99
Lakes (Larger than 500 acres each)		24,600	1
Map Area		4,535,680	100

cryptogams, forbs, or grasses suitable for grazing or browsing use. Rangeland includes tundra, many wetlands, forb and shrub communities, deserts, natural grasslands, and savannas.

A range site is a distinctive kind of rangeland that differs from other kinds of rangeland in its ability to produce a characteristic natural plant community. A range site is the product of all the environmental factors responsible for its development. It is capable of supporting a native plant community typified by an association of species that differs from that of other range sites in the composition of species or in total production. Range sites are ecological subdivisions of the rangeland landscape - for study, evaluation and management. They are the basis for mapping the rangeland landscape and inventorying the range. With grazing or browsing use, the same plant may "increase" or "decrease" within any grazing year, depending on the season of year the plant is used, by type of animal using the plant and intensity of use.

Range condition is the present state of vegetation of a range site in relation to the climax (natural potential) plant community for that site. It is an expression of the relative degree to which the kinds, proportions, and amounts of plants in a plant community resemble that of the climax plant community for the site. Range condition is basically an ecological rating of the plant community. Air-dry weight is the unit of measure used in comparing the composition and production of the present plant community with that of the climax community.

Trend is the direction of change in range condition. The present range condition is a result of a sustained trend over a period of time. Trend is a much more sensitive indicator of change than condition.

Soils in the Kotzebue Sound Soil Survey Area have been correlated with fourteen range sites. Their location and distribution are shown on the range sites and soils map attached to this report; acreage and proportionate extent are given in Table 2.

IU1 ACID ROCK DESERT (Rubble land - Pergelic Cryumbrepts Association)

This mapping unit occurs on ridges of hills and mountains and is made up of about 10 to 20 percent Pergelic Cryumbrepts and 80 to 90 percent Rubble land.

Pergelic Cryumbrepts in this mapping unit consist of well drained soils that have a peaty surface mat about one inch thick over very dark grayish brown and dark brown very gravelly sandy loam that becomes more gravelly with depth. Granite fragments make up more than 50 percent of the volume of the soil. These soils have moderate permeability. There are many roots in the upper organic mat and roots are common to a depth of 10 inches or more. Because the mat of organic matter on the surface is thin, the permafrost table is commonly deeper than 40 inches.

Representative profile of the Pergelic Cryumbrepts subgroup, SW¼ NW¼ of Section 33, T.1N., R.12 W. (Stop No. 52)

02	1-0"	Dark reddish brown (5YR 3/2) well decomposed peat; many roots; extremely acid; abrupt wavy boundary.
A11	0-1"	Very dark grayish brown (10YR 3/2) very gravelly sandy loam; weak fine granular structure; very friable, nonsticky, nonplastic; common roots; extremely acid; abrupt wavy boundary.
A12	1-10"	Dark brown (10YR 3/3) very gravelly sandy loam; weak medium and fine subangular blocky structure; very friable, nonsticky, nonplastic; common roots; strongly acid.

Rubble land consists of granitic stones and boulders, virtually free of soil and vegetation except for lichens.

Included in this mapping unit are small areas of Histic Pergelic Cryaquepts, Pergelic Cryaquepts, and Pergelic Cryorthents.

Original Native (climax) Vegetation: This site is characterized by granitic bald rubble slopes and mountain tops that are highly wind affected. They are at the highest elevations of any site on the Seward Peninsula. Viewed from a distance, rock rubble and cryptogams dominate the landscape.

Relative percent composition of the total plant community:

	Percent composition by weight (air-dry) current year's growth[A/]	Season of use by animal [A/]
GRASSLIKES/GRASS	(5)	
Sedge (Carex nardina)	5	RS MXY
Sheathed sedge (Carex vaginata), woodrush (Luzula sp.), and bluegrass (Poa alpigena) are minor components of the original native vegetation.		
FORBS	(5)	
Mountain saxifrage (Saxifraga oppositifolia)	5	
Oxytrope (Oxytropis sp.), arnica (Arnica sp.), fireweed (Epilobium sp.), pasqueflower (Anemoe patens), crowfoot (Ranuculus sp.), harebell (Campanula sp.) and pussytoes (Antennaria) and northern Indian paintbrush (Castilleja hyperborea) are minor components of the original native vegetation.		

	Percent composition by weight (air-dry) current year's growth[A/]	Season of use by animal [A/]
SHRUBS/SUBSHRUBS	(15)	
Dryas (Dryas octopetala)	10	RW RSp MXW
Skeletenleaf willow (Salix phlebophylla)	5	RSp MXW
Mountain heather (Cassiope tetragona)	Trace	
Lowbush cranberry (Vaccinium vitis-idaea), and crowberry (Empetrum nigrum) are minor components of the original native vegetation.		
CRYPTOGAMS	(75)	
Whitebranched lichen (Cladonia sp.)	45	RW
Squawhair lichen (Cornicular divergens)	15	RW
White tubular lichen (Cetraria cucullata)	10	RW
Brown prickly lichen (Cetraria islandica)	5	RW
Other lichens, Lycopodium sp., and other mosses are parts of the original native vegetation.		
TOTAL	100	

Total average production on this site is 500 pounds per acre of air-dry vegetation per year, (current year's growth), 400 pounds per acre in a less favorable year, and 600 pounds per acre in a more favorable year.

This is an important reindeer range site because the vegetation is usually available throughout much of the winter. During summer this site is usually windy and thus relatively free of insects. If wet, the lichens are edible. Over three-fourths of the production, (current year's growth,) is by plants that are potentially available as food for reindeer (80 percent winter and 20 percent spring-summer).

At least one-fourth of the production (current year's growth) is potentially valuable muskox winter range forage.

This site requires a long time to recover from overgrazing and most of the new growth comes from plants that are already established rather than from new plants. Rotational use of the range is necessary in commercial reindeer husbandry to provide protection to the range resource.

This site occurs adjacent to the LOW SHRUB, MIXED SHRUB, and SPARSE SHRUB TUSSOCK TUNDRA and BRUSHY DRAINAGES range sites, and therefore, provides varied habitat for wolf, brown bear, muskox, ptarmigan, bald eagle, golden eagle, raven, and various other birds.

A/ See Glossary.

MB ALKALINE ROCK DESERT (Pergelic Cryoborolls)

The mapping unit occupies gently sloping to hilly ridges and slopes. The vegetative cover is interrupted by bare frost scars, stone stripes, and gravelly step formations. Bald, calcareous, and stony upper ridgetops characterize the area.

Pergelic Cryoborolls in this mapping unit consists of well-drained gravelly calcareous soils that formed in materials derived from limestone, marble, and micaceous schist. They have a thin peaty surface mat about 1 inch thick over a dark reddish brown, silt loam upper horizon, and a dark olive gravelly silt loam lower horizon that becomes more gravelly and lighter-colored with depth.

Calcareous micaceous schist fragments make up more than 50 percent of the underlying C horizon; lime accumulates on the undersides of the fragments.

The soils have moderate permeability. There are many roots in the upper 5 inches with few extending to a depth of 14 inches. The permafrost table is commonly deeper than 40 inches.

Representative profile of the Pergelic Cryoborolls subgroup, SW¼ SW¼ of Section 21, T.5N.,R.23W. (Stop No. 6)

02	1-0"	Black (10YR 2/1) well decomposed organic matter; many roots; clear smooth boundary.
A11	0-5"	Dark reddish brown (5YR 3/2) silt loam; weak very fine granular structure; very friable, slightly sticky, slightly plastic; many roots; slightly calcareous; abrupt irregular boundary.
A12	5-14"	Dark olive (5Y 3/3) gravelly silt loam; weak medium angular blocky structure; very friable, slightly sticky, slightly plastic; few roots; strongly calcareous; clear wavy boundary.
C1	14-18"	Olive (5Y 5/3) very gravelly silt loam; massive; very friable, slightly sticky, slightly plastic; strongly calcareous.

Included in this mapping unit are about 5 to 10 percent bare frost scars, stone stripes, and gravelly step formations. Also included are small areas of Histic Pergelic Cryaquepts, Pergelic Cryaquepts, Pergelic Cryorthents, and bald, stony ridgetops.

Original Native (climax) Vegetation: This site, which occupies some of the highest elevations on the Seward Peninsula, is characterized by calcareous bald rubble slopes and mountain tops that are highly wind affected. The vegetation is predominately low growing shrubs.

Relative percentage composition of the total plant community:

	Percent composition by weight (air-dry) current year's growth[A/]	Season of use by animal [A/]
GRASSLIKES/GRASS	(15)	
Bigelow sedge (Carex bigelowii)	10	RS MXW
Sedge (Carex nardina)	5	RS MXW
Other sedges (Carex sp.), bluegrass (Poa alpigena) and cottongrass (Eriophorum sp.) are minor parts of the original native vegetation.		
FORBS	(5)	
Mountain saxifrage (Saxifraga oppositifolia)	5	
Astragalus (Astragalus sp.), northern Indian paintbrush (Castilleja hyperborea), saussurea (Saussurea angustifolia), false asphodel (Tofieldia pusilla), oxytrope (Oxytropis sp.) and lousewort (Pedicularis sp.) are minor components of the original native vegetation.		
SHRUBS/SUB-SHRUBS	(65)	
Entireleaf mountain avens (Dryas integrifolia)	30	RW RSp
White mountain avens (Dryas octopetala)	22	RW RSp
Arctic willow (Salix arctica)	7	RSp MXW
Netleaf willow (Salix reticulata)	3	RSp MXW
Mountain heather (Cassiope tetragona)	3	RSp MXW
Blueberry (Vaccinium uliginosum), crowberry (Empetrum nigrum), redfruit bearberry (Arctostaphylos rubra) are minor components of the original native vegetation.		
CRYPTOGAMS	(15)	
White branched lichen (Cladonia sp.)	8	RW
White tubular lichen (Cetraria cucluata)	5	RW
Yellow lichen (Cetraria tilesii)	2	RW
TOTAL	100	

This site produces on an average 500 pounds of air-dry vegetation per acre (current year's growth); 400 pounds per acre in a less favorable year, and 600 pounds per acre in a more favorable year.

Even though low in productivity with relatively few lichens, this site could be listed as an important reindeer range site because the vegetation

A/ See Glossary.

is usually available throughout much of the winter. During the summer, the reindeer seek this windy site to get relief from insects. If wet, some food is available from lichens. Approximately all of the production, current year's growth, is from plants potentially available as food for reindeer (2/3 of it in winter and 3/4 in spring/summer).

At least 1/4 of the production (current year's growth) is potentially valuable muskox winter range forage.

This site requires a long time to recover from overgrazing and most of the new growth comes from plants that are already established rather than from new plants. Since the high ridges are blown clear of snow during the winter and cool breezes offer relief from insect pestilence in summer, reindeer could overutilize this site, leading to rapid deterioration of the range. Rotational use of the range is necessary in commercial reindeer husbandry to provide protection to the range resource.

High wind velocities on this site give protection to wildlife from insects during the summer. Tundra hare, muskox, ptarmigan, brown bear are wildlife frequenting this site.

EO ALLUVIAL MIXED FOREST (Pergelic Cryorthents)

Pergelic Cryorthents in this mapping unit consist of well drained soils formed in stratified alluvial sediments on the flood plains of rivers and streams. Typical profiles have dark gray to very dark grayish brown silty and sandy materials 12 to 30 inches deep over very gravelly loamy sand or layers of gravel. The soils are nearly level, but most areas are dissected by sloughs, oxbow lakes, and former stream channels. Soil permeability is moderate in the surface horizon and moderately rapid or rapid in the underlying horizons. There are many roots in the upper soil horizons, but there are few or none in the underlying gravel. The permafrost table, if present, is commonly deeper than 40 inches.

Representative profile of the Pergelic Cryorthents subgroup, SE¼ SE¼ of Section 35, T.2N.,R.11W. (Stop No. 53)

C1 0-9" Very dark grayish brown (10YR 3/2) silt loam; weak very fine and fine granular structure; very friable, nonsticky, nonplastic; many roots; slightly acid; abrupt smooth boundary.

IIC2 9-17" Very dark grayish brown (10YR 3/2) sandy loam; massive; very friable, nonsticky, nonplastic; many roots; medium acid; abrupt smooth boundary.

IIIC3 17-30" Very dark grayish brown (10YR 3/2) very gravelly loamy sand; single grain; loose, nonsticky, nonplastic; about 80 percent rounded gravel.

A thin dark A horizon may be present. The strata vary considerably in arrangement, thickness, and texture.

Included in this mapping unit are small areas of Histic Pergelic Cryaquepts, Pergelic Cryaquepts, and Pergelic Cryofibrists.

Original Native (climax) Vegetation: The vegetation is a white spruce-balsam poplar dominated community on alluvial floodplains.

Relative percentage composition of the "understory" plant community:

	Percent composition by weight (air-dry) current year's growth[A/]	Season of use by animal [A/]
GRASS/GRASSLIKES	(20)	
Bluejoint (Calamagrostis canadensis)	20	MS MXS
Sedges (Carex sp.) and bluegrasses (Poa sp.) are minor components of the original native vegetation.		
FORBS	(25)	
Northern bedstraw (Galium boreale)	5	MXS
Wintergreen (Pyrola sp.)	5	MW MXS
Northern groundsel (Senecio hyperborealis)	5	MS MXS
Wormwood (Artemisia tilesii)	5	
Arctic lupine (Lupinus arcticus)		MS
Nagoon berry (Rubus arcticus)	5	MXS
Tall bluebell (Mertensia paniculata)		
Fireweed (Epilobium latifolium), monkshood (Aconitum delphinifolium), astragalus (Astragalus sp.) are minor parts of the forb original native vegetation.		
SHRUBS	(55)	
Feltleaf willow (Salix alaxensis)	20	RSp MW MXS
American green alder (Alnus crispa)	15	MW
Barren ground willow (Salix brachycarpa)	10	RSp MW MXS
Blueberry (Vaccinium uliginosum)	5	RW
Prickly rose (Rosa acicularis)	5	
Bunchberry (Cornus canadensis), crowberry (Empetrum nigrum), and lowbush cranberry (Vaccinium vitis-idaea) are minor parts of the shrub original native vegetation.		
TOTAL	100	

A/ See Glossary

TREES
Balsam poplar (Populus balsamifera)
White spruce (Picea glauca)

Overstory canopy is 60% cover

Wood land production potential at 9" diameter:

- trees per acre - 110
- basal area per acre - 45 sq. ft.

The understory of this site produces an average of 750 pounds per acre (air-dry vegetation), each year; current year's growth (understory); 500 pounds per acre in less favorable years and 1000 pounds per acre in more favorable years.

This site provides important moose habitat. Approximately 70 percent of the current year's growth from understory production is plants potentially used as moose food. (50 percent winter and 25 percent summer).

This site provides important summer muskox habitat. About 3/4 of the current year's growth of understory production is from plants potentially available as summer food.

Due to the overflow nature of this site and its corresponding plant community, potential ecological change from ungulate use is minimal

This site has a high potential for wildlife habitat because of the great variety and abundance of forbs and shrubs produced. It is associated with the following range sites: LOW SHRUB, MIXED SHRUB, and SPARSE SHRUB TUSSOCK TUNDRA, DRAINED LAKE BORDERS, BRUSHY DRAINAGES, UPLAND WHITE SPRUCE, and ALLUVIAL TALL SHRUB. It provides habitat for ptarmigan, geese and related waterfowl, ducks, snowshoe and tundra hare, fox, red and arctic ground squirrel, lynx, ermine, marten, mink and beaver. Wolf, brown bear, and muskox also inhabit the site.

IQ7 ALLUVIAL TALL SHRUB (Pergelic Cryaquepts)

Pergelic Cryaquepts in this mapping unit consist of poorly drained soils formed in silty alluvial sediments on the higher areas of flood plains of the larger rivers and streams. They have a peaty surface mat less than 8 inches thick over a thin, very dark grayish brown silt loam A horizon about 2 inches thick. The subsoil is a mottled dark grayish brown silt loam about 14 inches thick above the permafrost table.

The soils are nearly level, but most areas are dissected by sloughs, oxbow lakes, and former stream channels. Soil permeability is moderate above the permafrost but, because the soils are always close to saturation, the intake rate of water is slow; both vertical and lateral movement of water through the soil is slow. A large proportion of the annual

precipitation is lost as surface runoff. Plant roots are mostly in the peaty mat and upper mineral soil, but some penetrate to the permafrost table.

Representative profile of the Pergelic Cryaquepts subgroup, NE¼ NE¼ of Section 21, T.7N., R.12W. (Stop No. 32)

O1	7-5"	Dark brown (7.5YR 3/2) partly decomposed peat; many roots; very strongly acid; clear smooth boundary.
O2	5-0"	Dark brown (7.5YR 3/2) well decomposed peat; many roots; very strongly acid; clear smooth boundary.
A1	0-2"	Very dark grayish brown (10YR 3/2) silt loam; weak fine granular structure; very friable, slightly sticky, slightly plastic; many roots; slightly acid; abrupt smooth boundary.
B2g	2-16"	Dark grayish brown (10YR 4/2) silt loam; common medium prominent dark yellowish brown (5YR 3/4) mottles; weak very coarse platy structure; very friable, slightly sticky, slightly plastic; common roots; slightly acid.
Cgf	16"+	Dark gray (10YR 4/1) silt loam (frozen 8/8/76)

Texture of the A, B, and C horizons ranges from sandy loam to silty clay loam. Depth to the permafrost table ranges from 15 to 30 inches, and thickness of the surface organic mat ranges from 0 to 8 inches.

Included in this mapping unit are up to 15 percent Histic Pergelic Cryaquepts, Pergelic Cryofibrists, and Pergelic Cryorthents. Also included are small areas of frost scars where frost action has destroyed the organic surface mat and exposed the mineral soil.

Original Native (climax) Vegetation: The vegetation is tall (to 10 feet) alders and willows on alluvial plains with a rather sparse understory of grasses, forbs and cryptogams.

Relative percentage composition of the total plant community:

	Percent composition by weight (air-dry) current year's growth[A/]	Season of use by animal [A/]
GRASS/GRASSLIKES	(5)	
Bluejoint (Calamagrostis candensis)	5	MS MXS
Bluegrass (Poa pratensis)	Trace	
FORBS		
Ground-cone (Boschniakia rossica), brook saxifrage (Saxifraga punctata), astragalus (Astragalus sp.), coltsfoot (Petasites frigidus), nagoon berry (Rubus arcticus), monkshood (Aconitum delphinifolium), northern bedstraw		

	Percent composition by weight (air-dry) current year's growth[A/]	Season of use by animal [A/]
(Galium boreale), and marsh cinquefoil (Potentilla palustris) are minor forbs in the original native vegetation.		
SHRUBS/SUB-SHRUBS	(90)	
American green alder (Alnus crispa)	75	MW
Diamondleaf willow (Salix planifolia)	15	RSp MW MS MXS
Red currant (Ribes triste), and Richardson willow (Salix richardsonii) are minor components of the original native vegetation.		
CRYPTOGAMS	(5)	
Horsetail (Equisetum arvense)	5	RSp MS MXS
TOTAL	100	

Total production on this site is on the average 2500 pounds per acre of air-dry vegetation, current year's growth, 2000 pounds per acre on less favorable years, and 3000 pounds per acre in more favorable years.

This site is one of the most important moose habitats in the survey area. Approximately 100 percent of the current year's growth production is from plants potentially used as moose food (90 percent in winter and 25 percent in summer).

For muskox, at least one-quarter of the total production (current year's growth), is from plants with potential as summer food. Much potential food is out of reach for muskox.

This site is subject to overflow. Therefore, it is not subject to erratic ecological change from browse use. If fire should change this site, alder and willow would recur.

This site is important habitat for snowshoe and tundra hare, fox, red and arctic ground squirrel, lynx, ermine, and beaver. Wolf, brown bear, and muskox also use the site. This is an important nesting site for white-fronted geese and it is yearlong moose habitat. Arctic grayling, arctic char, and dog salmon are found in adjacent rivers.

BEACH DUNES RANGE SITE

This range site consists of narrow strips of sand dunes bordering beaches too small to delineate on the Range Site and Soil Map. The

A/ See Glossary.

soils are sandy throughout and have no developed horizons. They are classified as Pergelic Cryopsamments.

Original Native (climax) Vegetation: The original vegetation is characterized by beach ryegrass up to four feet in height.

Relative percent composition of the total plant community:

	Percent composition by weight (air dry) current year's growth[A/]	Season of use by animal [A/]
GRASS/GRASSLIKES	(80)	
Beach ryegrass (Elymus mollis)	60	MXW
Speargrass (Poa eminens)	20	MXW
FORBS	(20)	
Beach pea (Lathyrus maritimus)	15	MXY
Beach lovage (Ligusticum mutellinoides)	5	MXY
Wormwood (Artemisia Tilesii)	Trace	
Fireweed (Epilobium glandulosum), and angelica (Angelica sp.), are minor components of the original native vegetation.		
CRYPTOGAMS	Trace	
Horsetail (Equisetum sp.) are found in minor amounts in the original native vegetation.		
TOTAL	100	

Average annual (air-dry) production for this site is 2500 pounds per acre 2000 in less favorable years, and 3000 in more favorable years.

It is occasionally used by reindeer during the summer when they are on the beach attempting to avoid insects or cool off.

This site is potentially valuable winter range for muskox. All the forage produced on this site (current year's growth) can provide feed for muskox (80 percent in winter, and potentially 100 percent yearlong.)

If overused or denuded of vegetation, Elymus rhizomes will resprout to form the only vegetation on the denuded area.

IQ6 BRUSHY DRAINAGES (Pergelic Cryaquepts)

The mapping unit is adjacent to drainageways traversing level to rolling broad ridges, upper valley slopes, and hillsides. It also occurs within typically level inland lake systems where microrelief provides sufficient drainage for the growth of moderately tall shrubs. Pergelic Cryaquepts

A/ See Glossary.

in this mapping unit consist of poorly drained soils formed in silty materials. They have a peaty surface mat about 6 inches thick over a mottled dark gray silt loam. Ice-rich permafrost is about 24 inches below the base of the mat.

The soils have moderate permeability above the permafrost table but, because they are always close to saturation, the intake rate of water is slow; both vertical and lateral water movement through the soil is slow. A large proportion of the annual precipitation is lost as surface runoff. Plant roots are mostly in the upper peaty mat, but some penetrate to the permafrost table.

Under undisturbed conditions, there is slight or no erosion. Disruption of the peaty surface mat, however, can result in localized increased depth of thaw and, even on gentle slopes, severe gullying.

Representative profile of the Pergelic Cryaquepts subgroup, SE¼ SE¼ Section 16, T.5N., R.19W. (Stop No. 19)

01	6-4"	Dark yellowish brown (10YR 3/4) raw fibrous hypnum peat; many roots;extremely acid; clear smooth boundary.
02	4-0"	Black (5YR 2/1) well decomposed peat; many roots; extremely acid; clear wavy boundary.
B2g	0-24"	Dark gray (5YR 4/1) silt loam; common medium prominent dark reddish brown (5YR 3/4) mottles; weak medium subangular blocky structure; friable, slightly sticky, slightly plastic; many roots; medium acid.
Cgf	24"+	Dark gray (5Y 4/1) silt loam (frozen 8/3/76).

A thin very dark A1 horizon may be present. Texture ranges from loam to silty clay loam, and the proportion of gravel ranges from 0 to 35 percent. Depth to the permafrost table ranges from 15 to 30 inches, and thickness of the surface organic mat ranges from 0 to 8 inches.

Inclusions of other kinds of soil make up 5 to 15 percent of most delineations. These include Histic Pergelic Cryaquepts, Pergelic Cryoborolls, Pergelic Cryofibrists, Pergelic Cryorthents, and Pergelic Cryumbrepts. Also included are small areas of frost scars where frost action has destroyed the surface organic mat and exposed the mineral soil.

Original Native (climax) Vegetation: This site is characterized by long, narrow brush plant communities, generally following streams. This site is on slopes and is not alluvial, but does occupy areas of microrelief within inland lake systems. Tall brush (alder and willow) averaging six feet in height are dominant.

Relative percentage composition of the total plant community:

	Percent composition by weight (air-dry) current year's growth[A/]	Season of use by animals[A/]
GRASSLIKES/GRASS	(25)	
Bigelow sedge (Carex bigelowii)	15	RSp RS MW MS MXS
Bluejoint (Calamagrostis canadensis)	5	MS MXS
Tussock cottongrass (Eriophorum vaginata)	5	RSp MXS
Other sedges, including Carex saxatilis and sheathed sedge (Carex vaginata), Wahlenberg woodrush (Luzula wahlenbergii), small-flowered woodrush (Luzula parviflora) and other woodrushes including (Luzula multiflora), fescues including (Festuca altaica) and red fescue (Festuca rubra), polargrass (Arctagrostis latifolia), bluegrass including Poa alpigena and arctic bluegrass (Poa arctica) and bluejoint (Calamagrostis canadensis) are minor components of the original native vegetation.		
FORBS	(10)	
Arctic sweet coltsfoot (Petasites frigidus)	5	RSp MS MXS
Cloudberry (Rubus chamaemorus)	5	MS MXS
Following are forbs that are included in the minor part of the original native vegetation: capitate lousewort (Pedicularis capitata), Jacob's-ladder (Polemonium acutiflorum), meadow bistort (Polygonum bistorta), shooting star (Dodecatheon jeffreyi), spring beauty (Claytonia sarmentosa), nagoon berry (Rubus arcticus), monkshood (Aconitum delphinifolium), grass-of-parnassus (Parnassia sp.), grass-leaved sorrel (Rumex graminifolius), fireweed (Epilobium angustifolium), large flower wintergreen (Pyrola grandiflora), astragalus (Astragalus sp.), bedstraw (galium sp,) and saxifrage (Saxifraga sp.).		
SHRUBS/SUB-SHRUBS	(65)	
Diamondleaf willow (Salix planifolia)	25	RSp RS MW MS MXS
Green alder (Alnus crispa)	20	MW
Blueberry (Vaccinium uliginosum)	10	RW
Dwarf birch (Betula nana)	5	RSp MW MS
Labrador tea (Ledum decumbens)		
Beauverd spirea (Spiraea beauveriana)	5	
Crowberry (Empetrum nigrum)		

A/ See Glossary.

	Percent composition by weight (air-dry) current year's growth[A/]	Season of use by animals [A/]
Following is a list of shrubs/sub-shrubs that are included as a minor part of the original native vegetation: Lowbush cranberry (Vaccinium vitus idaea), alpine bearberry (Arctostaphylos alpina), glandular birch (Betula glandulosa), netleaf willow (Salix reticulata), arctic willow (Salix arctica), dryas (Dryas sp.), and woody cinquefoil (Potentilla fruticosa).		
CRYPTOGAMS	(5)	
Horsetail (Equisetum arvense)	5	MS MXS
Other cryptogams in minor amounts include lichens and varigated scouring rush (Equisetum variegatum).		
TOTAL	100	

Total annual production for this site is approximately 1500 pounds of air-dry vegetation per acre (current year's growth) in favorable years and 1250 pounds of air-dry production per acre in less favorable years.

This site includes some of the best moose and muskox habitat in the survey area. It is represented by the finger drainages etched across the landscape. Approximately 80 percent of the current year's growth of production is from plants used by moose (60 percent summer and 60 percent winter.). For muskox approximately 70 percent of the current year's production is from plants potentially utilized as spring, summer, and early fall food.

The BRUSHY DRAINAGES range site is important for spring use by reindeer. Approximately 55 percent of the current year's production is from plants potentially used as reindeer food (10 percent winter and 55 percent spring). This site furnishes necessary spring and early summer food primarily from emerging willow leaves. Even though it produces an abundance of reindeer summer feed, it is so situated as to provide little insect relief (tall brush and the physiographic position of this site restricts wind.) Other sites more favorable to reindeer's various needs can better fulfill the summer forage needs.

This site is important habitat for snowshoe and tundra hare, fox, red and arctic ground squirrel, lynx, ermine, and beaver. Wolf, brown bear, and muskox also use the site. It is an important nesting site for white-fronted geese and is a key range site for yearlong moose habitat. Arctic char and grayling are in nearby streams.

HF2 DRAINED LAKE BORDERS (Pergelic Cryofibrists - Histic Pergelic Cryaquepts Association)

This mapping unit occupies broad depressions, drained thaw lake borders, and shallow drainageways of level valley bottoms and basins. It is made up of about 60 to 80 percent Pergelic Cryofibrists and 20 to 40 percent Histic Pergelic Cryaquepts. Low centered polygons 20 to 40 feet in diameter and low pressure ridges of various lengths commonly occur on the surface. The Pergelic Cryofibrists occupy the low areas between the pressure ridges and Histic Pergelic Cryaquepts are on the ridges and elevated polygon edges.

The soils in this mapping unit have moderate permeability above the permafrost but, because they are always close to saturation, the intake rate of water is slow; both vertical and lateral water movement through the soil is slow. Plant roots are mostly in the upper part, but a few penetrate to the permafrost table. These soils are wet all year, have slow surface runoff and have slight or no erosion hazard.

The Pergelic Cryofibrists subgroup consists of very poorly drained soils that have shallow permafrost tables. In this mapping unit they are composed of layered fibrous moss and sedge peat. Ice-rich permafrost is about 10 to 20 inches below the surface of the soil.

Representative profile of the Pergelic Cryofibrists subgroup, NE¼ NW¼ of Section 4, T.8N., R.25W. (Stop No. 4B)

Oi1	0-2"	Dark reddish brown (5YR 2/2) fibrous sedge peat (90 percent fiber after rubbing); many roots; extremely acid; clear smooth boundary.
Oi2	2-18"	Dark reddish brown (5YR 3/3) fibrous sedge peat (80 percent fiber after rubbing); common roots; extremely acid; abrupt wavy boundary.
Cgf	18-20"	Dark gray (5Y 4/1) silt loam (frozen 7/29/76).

Histic Pergelic Cryaquepts in this mapping unit consist of poorly drained soils that have a peaty surface mat, 8 to 16 inches thick, over mottled dark gray silt loam. Ice-rich permafrost is at or a few inches below the base of the mat.

Representative profile of the Histic Pergelic Cryaquepts subgroup, NE¼ NW¼ of Section 4, T.8.N, R.25W.

Oi1	9-6"	Very dusky red (2.5YR 2/2) fibrous hypnum moss peat; many roots; extremely acid; abrupt smooth boundary.
Oi2	6-0"	Black (5YR 2/1) hemic peat; common roots; very strongly acid; abrupt wavy boundary.

B2g 0-2" Dark gray (5Y 4/1) silt loam; common large distinct very dark grayish brown (2.5Y 3/2) and common medium distinct dark grayish brown (10 YR 4/2) mottles; massive; very friable, slightly sticky, slightly plastic; few roots; strongly acid.

Cgf 2"+ Dark gray (5Y 4/1) silt loam (frozen 7/29/76)

Included in this mapping unit are up to 15 percent Pergelic Cryaquepts and Pergelic Cryorthents. Small areas of the BEACH DUNES range site occur as narrow strips along the coastline. The soils on the dunes are Pergelic Cryopsamments. Also included are small areas of frost scars where frost action has destroyed the organic surface mat and exposed the mineral soil.

Original Native (climax) Vegetation: This site normally occurs as a complex of range sites. Approximately 2/3 is characterized by very poorly drained low center polygons at the edge of water bodies. The remaining 1/3 is the Low Shrub Tussock Tundra range site, which occupies the better drained ridge overlying ice wedges; together they form a mosaic, patterned surface ecosystem.

Relative percent composition of the total plant community:

	Percent composition by weight (air-dry) current year's growth[A/]	Season of use by animal [A/]
GRASSLIKES/GRASS	(75)	
Water sedge (Carex aquatilis)	60	RS RF MXY
Sedge (Carex rotundata)	15	RS RF MXY

Other grasslike plants include Bigelow sedge (Carex bigelowii), and capitate sedge (Carex capitata), tall cottongrass (Eriophorum angustifolium), white cottongrass (Eriophorum scheuchzeri) and arctic rush (Juncus arcticus) are minor components of the original native vegetation.

SHRUBS	(25)	
Labrador tea (Ledum decumbens)	15	MXW
Dwarf birch (Betula nana)	5	RSp MXW
Crowberry (Empetrum nigrum)	5	MXW

Diamondleaf (Salix planifolia) and bog willow (Salix fuscescens), redfruit bearberry (Arctostaphylos rubra), blueberry (Vaccinium uliginosum), lowbush cranberry (Vaccinium vitis-idaea) and leatherleaf (Chamaedaphne calyculata) are minor components of the original native vegetation.

	Percent composition by weight (air-dry) current year's growth A/	Season of use by animal A/
FORBS		
Swamp cranberry (Oxycoccus microcarpus), lousewort (Pedicularis sp.) and cloudberry (Rubus chamaemorus) are minor parts of the original native vegetation.		
TOTAL	100	

Total average production for this site is approximately 500 pounds per acre air-dry vegetation (current year's growth).

Approximately 75 percent of the total production is from plants potentially used as forage/browse for reindeer - primarily summer and fall.

Nearly all the total production is from plants potentially used as food for muskox (yearlong range). This site provides excellent fall and spring waterfowl and shorebird habitat. It is interspersed with the LOW SHRUB, MIXED SHRUB, and SPARSE SHRUB TUSSOCK TUNDRA, and BRUSHY DRAINAGES range sites. Therefore, it provides varied habitat for ptarmigan, bald eagle, golden eagle, raven, various birds, wolf, brown bear, and muskox.

HF1 DRAINED LAKES (Pergelic Cryofibrists)

This mapping unit occupies broad depressions, drained thaw lakes, and shallow drainageways of level valley bottoms and basins. Pergelic Cryofibrists in this mapping unit consist of very poorly drained soils that have shallow permafrost tables. They are composed of layered fibrous moss and sedge peat. Ice-rich permafrost is about 15 inches below the surface of the soil.

The soils have moderate permeability above the permafrost table, but, because they are always close to saturation, the intake rate of water is slow; both vertical and lateral water movement through the soil is slow. Plant roots are mostly in the upper peaty mat, but some penetrate to the permafrost table. These soils are wet all year, have slow surface runoff, and have slight or no erosion hazard. The vegetation is mostly sedge plants.

Representative profile of the Pergelic Cryofibrists subgroup, NE¼ NW¼ of Section 4, T.8N., R.25 W. (Stop No. 4A)

Oi1 0-3" Dark reddish brown (5YR 2/2) fibrous sedge peat (95 percent fiber after rubbing); many roots; very strongly acid; clear smooth boundary.

A/ See Glossary.

Oi2 3-15" Dark reddish brown (5YR 3/3) fibrous sedge peat (95 percent fiber after rubbing); common roots; very strongly acid.

Oi3f 15"+ Same as 3-15" layer, but frozen with seams of clear ice.

Included in this mapping unit are up to 15 percent Histic Pergelic Cryaquepts, Pergelic Cryaquepts, and Pergelic Cryorthents. Small areas of the BEACH DUNES range site occur as narrow strips along the coastline. Soils on the dunes are Pergelic Cryopsamments. Also included are small areas of frost scars where frost action has destroyed the organic surface mat and exposed the mineral soil.

Original Native (climax) Vegetation: This site is characterized as a sedge marsh meadow, generally with distinct boundaries (the shorelines of old lakes). It also occurs along ponds and streams. Water sedge (Carex aquatilis) comprises three-fourths the composition by weight (air-dry, current year's growth.)

Relative percentage composition of total plant community:

	Percent composition by weight (air-dry) current year's growth A/	Season of use by animals A/
GRASSLIKES/GRASS	(95)	
Water sedge (Carex aquatilis)	75	RS RF MXY
Capitate sedge (Carex capitata)	5	RS RF MXY
Russett cottongrass (Eriophorum russeolum)	5	MXY
White cottongrass (Eriophorum scheuchzeri)	5	MXY
Tall cottongrass (Eriophorum angustifolium)		
Arctic rush (Juncus arcticus)	5	
Other sedges (Carex rotundata), woodrush (Luzula wahlenbergii), bluegrass (Poa sp.), and blue-joint (Calamagrostis canadensis) are minor components of the original native vegetation.		
SHRUBS	(5)	
Labrador tea (Ledum decumbens)		
Dwarf birch (Betula nana)	5	FSp MXW
Leatherleaf (Chamaedaphne calyculata)		
FORBS		
Swamp cranberry (Oxycoccus microcarpus), lousewort (Pedicularis sp.), and marsh cinquefoil (Potentilla palustris) are minor components of the original native vegetation.		
TOTAL	100	

A/ See Glossary.

Total production for this site is approximately 1000 pounds of air-dry vegetation per acre in favorable years and 500 pounds per acre of air-dry production in less favorable years.

Potential reindeer value of this site: Approximately all the total production is from plants potentially used as food for reindeer - primarily summer and fall (80 percent).

Potential muskox value of this site: Approximately 95 percent of the total production is from plants potentially used as food for muskox (fair yearlong range.)

If the site is heavily trampled, the vegetation is churned into the peaty substratum. Recovery of the vegetation on trampled areas takes many years.

This site has potential for goose nesting. It is interspersed with the LOW SHRUB, MIXED SHRUB, and SPARSE SHRUB TUSSOCK TUNDRA, and BRUSHY DRAINAGES range sites, and, therefore, provides varied habitat for ptarmigan, bald eagle, golden eagle, raven, various birds, wolf, brown bear, and muskox.

LF LAVA BEDS (Lava Flows - Entisols Association)

This mapping unit occurs south of Imuruk Lake on the Continental Divide. It is composed of about 90 to 95 percent black lava rock and 5 to 10 percent of soils classified broadly as an association of Entisols.

The lava flow itself is a very prominent topographic feature; it is black, rough-surfaced and rippled, and has many cooling fractures and cones. The lava rock is virtually free of vegetation except for lichens.

Entisols in the association consist of soils that have little or no evidence of development of horizons. These soils occur as small pockets or patches of brown sandy loam usually less than one inch thick over lava rock. The area of the soil pockets range from 1 to 16 square feet. Vegetation is lowbush cranberry, blueberry, sedge, and lichen. Many small pothole lakes are interspersed within the lava flow.

A representative site of the Lava Flows - Entisols Association is located in the SW¼ NE¼ of Section 34, T. 2N., R.24 W. (Stop No. 25)

Original Native (climax) Vegetation: This is an association of sites made up of many small pothole lakes interspersed with lava beds. A distinctive plant community is developing on the soils of Entisols within the Association. The other 90 percent is bare lava rock supporting black lichen. The following relative percentages of the total plant community represents only 10% of the area. The remaining 90% is virtually bare lava rock.

Relative percent composition of the total plant community:

	Percent composition by weight (air-dry) current year's growth[A/]	Season of use by animal [A/]
GRASSLIKES/GRASS	(Trace)	
Sedge (Carex nardina) and Siberian oatgrass (trisetum sibiricum) are minor components of the original native vegetation.		
FORBS	(Trace)	
Saxifrage (Saxifraga sp.) is a minor component of the original native vegetation.		
SHRUBS/SUB-SHRUBS	(40)	
Lowbush cranberry (Vaccinium vitis-idaea)	40	
Woody cinquefoil (Potentilla fruticosa), diamondleaf willow (Salix planifolia), Arctic willow (Salix arctica), beauverd spirea (Spiraea Beauverdiana), mountain heather (Cassiope tetragona) crowberry (Empetrum nigrum), blueberry (Vaccinium uliginosum) and Labrador tea (Ledum decumbens) are minor parts of the original native vegetation.		
CRYPTOGAMS	(60)	
White branched lichen (Cladonia sp.)	30	RW
Squaw hair lichen (Cornicular divergens)	30	RW
Other lichens and fragrant shield-fern (Dryopteris fragrans) are minor parts of the original native vegetation.		
TOTAL	100	

Total production for the area supporting plants is approximately 500 pounds of air-dry vegetation per acre per year.

This is a relatively inaccessible site because of deep holes, faults, and covered potholes which act as pitfalls to the unwary ungulate. Local herders give testimony to reindeer using the site as winter range. In some areas, lichen production is much greater than reflected by this description.

Approximately 60 percent (mostly lichen) of the current year's production is from plants potentially used as reindeer food (the 60 percent lichen is preferred in winter if available and in summer if it is wet).

A/ See Glossary.

If overgrazed, this site requires a long time to recover. Most of the new growth comes from plants already established rather than from new plants. Pegau reported "the average annual linear growth rate on the principal forage lichens, Cladonia alpestris, C. rangiferina, and C. sylvatica on the Seward Peninsula was 5mm" (6). Some think this site is somewhat self-preserved from overgrazing because of its inaccessiblity.

This site is important winter wildlife habitat for snowshoe hare, rock ptarmigan, fox, and arctic ground squirrel. The small pothole lakes within the site attract waterfowl.

IQ2 LOW SHRUB TUSSOCK TUNDRA (Histic Pergelic Cryaquepts)

The mapping unit occupies level to rolling valleys, long footslopes of low hills, and broad basins. Histic Pergelic Cryaquepts in this mapping unit consist of poorly drained soils that have a peaty surface mat, 8 to 16 inches thick, over dark gray silt loam. Ice-rich permafrost is at or a few inches below the base of the mat.

The soils have moderate permeability above the permafrost table, but, because they are always close to saturation, the intake rate of water is slow; both vertical and lateral water movement through the soil is slow. A large proportion of the annual precipitation is lost as surface runoff. Plant roots are mostly in the upper peaty mat, but some penetrate to the permafrost table.

Under undisturbed conditions there is slight or no erosion. Disruption of the peaty surface mat, however, can result in localized increased depth of thaw and, even on gentle slopes, severe gullying.

Representative profile of the Histic Pergelic Cryaquepts subgroup, NE¼ SW¼ of Section 3, T.7N., R.18W. (Stop No. 21)

011	11-7"	Dark reddish brown (5YR 3/2) raw fibrous sedge peat; many roots; extremely acid; clear smooth boundary.
012	7-0"	Black (5YR 2/1) partly decomposed peat; many roots; extremely acid; clear wavy boundary.
A1	0-2"	Very dark gray (10YR 3/1) silt loam; massive; slightly sticky, slightly plastic; few roots; strongly acid; clear wavy boundary.
B2g	2-4"	Dark gray (5Y 4/1) silt loam; massive; slightly sticky, slightly plastic; strongly acid.
Cgf	4"	Dark gray (5Y 4/1) silt loam (frozen 8/4/76); slightly sticky and slightly plastic when thawed.

The thin, very dark A1 horizon may be absent. Thin, discontinuous dark organic streaks may occur in the C horizon as a result of frost stirring.

Texture of the C horizon ranges from loam to silty clay loam, and percent gravel ranges from 0 to 35 percent.

Inclusions of other kinds of soil make up 5 to 15 percent of most areas of this mapping unit. These include mostly Pergelic Cryaquepts, and small areas of Pergelic Cryoborolls, Pergelic Cryofibrists, Pergelic Cryorthents, and Pergelic Cryumbrepts. Small areas of the BEACH DUNES range site occur as narrow strips along the coastline. The soils on the dunes are Pergelic Cryopsamments. Also included are small areas of frost scars where frost action has destroyed the surface organic mat and exposed the mineral soil.

Original Native (climax) Vegetation: The vegetation is typically low shrub-cottongrass-sedge tussock tundra. The shrubs normally constitute about 55 percent of the plant composition by weight and are generally less than 18 inches tall.

Relative percent composition of total plant community:

	Percent composition by weight (air-dry) current year's growth A/	Season of use by animal A/
GRASSLIKES/GRASS	(30)	
Tussock cottongrass (Eriophorum vaginatum)	15	RSp MXS
Bigelow sedge (Carex bigelowii)	15	RSp RS MXS

Tall cottongrass (Eriophorum angustifolium), bluejoint (Calamagrostis canadensis), Wahlenberg woodrush (Luzula wahlenbergii), and other sedges (Carex sp.) are minor components of the original native vegetation.

SHRUBS	(55)	
Labrador tea (Ledum decumbens)	25	
Lowbush cranberry (Vaccinium vitis-idaea)	15	
Blueberry (Vaccinium uliginosum)	5	RW
Dwarf birch (Betula nana)	5	RSp
Crowberry (Empetrum nigrum)		
Alpine bearberry (Arctostaphylos rubra)	5	

Netleaf willow (Salix reticulata), and diamondleaf willow (Salix planifolia) also make up minor parts of the potential plant community.

FORBS
Cloudberry (Rubus chamaemorus), fireweed (Epilobium angustifolium), groundsel (Senecio sp.), arctic sweet coltsfoot (Petasites frigida) and saussurea (Saussurea angustifolia) are minor components of the original native vegetation.

IQ4 MIXED SHRUB TUSSOCK TUNDRA (Histic Pergelic Cryaquepts)

The mapping unit occupies level to rolling valleys, long footslopes of low hills, and broad basins Histic Pergelic Cryaquepts in this mapping unit consist of poorly drained soils that have a peaty surface mat, 8 to 16 inches thick, over dark gray silt loam. Ice-rich permafrost is at or a few inches below the base of the mat.

The soils have moderate permeability above the permafrost table, but, because they are always close to saturation, the intake rate of water is slow; both vertical and lateral water movement through the soil is slow. A large proportion of the annual precipitation is lost as surface runoff. Plant roots are mostly in the upper peaty mat, but some penetrate to the permafrost table.

Under undisturbed conditions there is slight or no erosion. Disruption of the peaty surface mat, however, can result in localized increased depth of thaw and, even on gentle slopes, severe gullying.

The vegetative cover is a dense, low growing cover of sedges, sphagnum moss, dwarf birch, Labrador tea, cloudberry, willows, and other plants. Lichens are common, but are inconspicuous underneath the other vegetation. Tussock-forming cottongrass is common in all areas.

Representative profile of the Histic Pergelic Cryaquepts subgroup, NW¼ SE¼ of Section 16, T.4N., R.14 W. (Stop No. 39)

01	13-11"	Dark yellowish brown (10YR 3/4) raw fibrous peat from sedge and sphagnum moss; many roots; extremely acid; abrupt smooth boundary.
012	11-0"	Dark reddish brown (5YR 2/2) partly decomposed peat; many roots; extremely acid; abrupt wavy boundary.
Cgf	0-10"	Dark gray (5Y 4/1) gravelly loam (frozen 8/13/76); slightly sticky and slightly plastic when thawed; extremely acid.

A thin very dark A1 horizon may be present. A dark gray B2 horizon may also be present. Texture of the C horizon ranges from loam to silty clay loam, and gravel ranges from 0 to 35 percent.

Inclusions of other kinds of soil make up 5 to 15 percent of most mapping units. These include Pergelic Cryaquepts, Pergelic Cryoborolls, Pergelic Cryofibrists, Pergelic Cryorthents, and Pergelic Cryumbrepts. Small areas of the BEACH DUNES range site occur as narrow strips along the coastline. The soils on the dunes are Pergelic Cryopsamments. Also included are small areas of frost scars where frost action has destroyed the organic surface mat and exposed the mineral soil.

Original Native (climax) Vegetation: This site is characterized by 60 percent shrubs. Fifteen percent (15 percent) of this is alder and willow to four feet in height. Bigelow sedge and tussock cottongrass make up one-third of the plant community, (air dry weight). Lichen is minimal.

Relative percentage composition of total plant community:

	Percent composition by weight (air-dry) current year's growth A/	Season of use by animal A/
GRASSLIKES/GRASS	(30)	
Bigelow sedge (Carex bigelowii)	15	RSp RS MW MS MXS
Tussock cottongrass (Eriophorum vaginatum)	15	RSp MXS
Spike trisetum (Trisetum spicatum), and fragile sedge (Carex membranacea) are minor components of the original native vegetation.		
SHRUBS	(60)	
Labrador tea (Ledum decumbens)	20	
American Green alder (Alnus crispa)	10	MW
Dwarf birch (Betula nana)	10	RSp MW MS
Blueberry (Vaccinium uliginosum)	10	RW
Lowbush cranberry (Vaccinium vitis-idaea)	5	MW
Diamondleaf willow (Salix planifolia)	5	RSp MW MS MXS
Crowberry (Empetrum nigrum), alpine bearberry (Arctostaphylos alpina), Lapland rosebay (Rhododendron lapponicum), and beauverd spirea (Spiraea Beauverdiana) are minor components of the original native vegetation.		
FORBS	(Trace)	
Wintergreen (Pyrola sp.), coltsfoot (Petasites frigida), meadow bistort (Polygonum bistorta), cloudberry (Rubus chamaemorus), and saussurea (Saussurea angustifolia) are minor components of the potential plant community.		
CRYPTOGAMS	(10)	
White branched lichen (Cladonia sp.)	5	RW MW
White tubular lichen (Cetraria cucullata)	5	RW MW
Other types of lichen occur in minor amounts.		
TOTAL	100	

A/ See Glossary.

Total annual production for this site is approximately 1500 pounds of air-dry vegetation per acre in years with favorable growing conditions; 1250 pounds in years with less favorable growing conditions. This site is especially important for reindeer in early summer, as the emerging willow leaves are one of the first and largest sources of green forage. It is utilized by reindeer throughout the summer, and to a lesser extent in the fall. Other sites may have more tall willow, but are situated in physiographic positions less favorable for insect relief (wind) as compared to this site. Approximately 65 percent of the total production is from plants which furnish potential food for reindeer (20 percent in winter/50 percent in spring-summer).

Approximately 55 percent of the total production (current year's growth) is from plants potentially used as moose food (55 percent in winter and 30 percent in summer). If used by muskox, this site would be fair summer range. Approximately 35 percent of the total production (current year's growth,) is from plants potentially used as summer food by muskox.

Rotational use of the range, especially winter range, is necessary in commercial reindeer husbandry in order to provide protection to the resource. This cannot be accomplished without PROPER HERDING. Field trials of fertilization and chiseling tussocks, as well as evaluation of past burns may contribute to the development of new management practices.

If fire occurs, Bigelow sedge, cloudberry, bistort, dwarf birch, alpine arctic bearberry, Labrador tea, blueberry and diamondleaf willow re-occur the following year (productivity is 20 percent of normal). By the second and third years' Labrador tea predominates, and tussock cottongrass and lowbush cranberry have appeared, with productivity to 70 percent of normal.

This site has a high potential for wildlife habitat. It is interspersed among BEACH DUNES, TIDAL MARSH, BRUSHY DRAINAGES, DRAINED LAKES, UPLAND WHITE SPRUCE, ACID and ALKALINE ROCK DESERT and their associated vegetation. This site provides habitat for ptarmigan, brown bear, wolf, muskox, bald eagle, golden eagle, raven and various other birds.

IQ3 SPARSE SHRUB TUSSOCK TUNDRA (Histic Pergelic Cryaquepts)

The mapping unit occupies level to rolling valleys, long footslopes of low hills, and broad basins. Numerous frost scars give the tundra a spotted appearance. Histic Pergelic Cryaquepts in this mapping unit consist of poorly drained soils that have a peaty surface mat, 8 to 16 inches thick, over dark gray silt loam. Ice-rich permafrost is at or a few inches below the base of the mat.

The soils have moderate permeability above the permafrost table, but, because they are always close to saturation, the intake rate of water is slow; both vertical and lateral water movement through the soil is slow. A large proportion of the annual precipitation is lost as surface runoff. Plant roots are mostly in the upper peaty mat, but some penetrate to the permafrost table.

Under undisturbed conditions there is slight or no erosion. Disruption of the peaty surface mat, however, can result in localized increased depth of thaw and, even on gentle slopes, severe gullying.

Representative profile of the Histic Pergelic Cryaquepts subgroup, SW¼ SE¼ of Section 19, T.4N., R.8W. (Stop No. 44)

Oi1	13-7"	Dark yellowish brown (10YR 4/4) raw fibrous sphagnum peat; many roots; extremely acid; abrupt smooth boundary.
Oi2	7-0"	Very dusky red (2.5YR 2/2) partly decomposed peat; many roots; extremely acid; abrupt wavy boundary.
Cgf	0-5"	Gray (5Y 5/1) silt loam (frozen 8/16/76); slightly sticky and slightly plastic when thawed; strongly acid.

A thin very dark A1 horizon may be present. A dark gray B2 horizon may also be present. Texture of the C horizon ranges from loam to silty clay loam, and percent gravel ranges from 0 to 35 percent.

Inclusions of other kinds of soil make up 5 to 20 percent of most areas of this mapping unit. These include Pergelic Cryaquepts, Pergelic Cryoborolls, Pergelic Cryofibrists, Pergelic Cryorthents, and Pergelic Cryumbrepts. Small areas of the BEACH DUNES range site occur as narrow strips along the coastline. The soils on the dunes are Pergelic Cryopsamments. Also included are Pergelic Ruptic - Histic Cryaquepts, which contain many small areas of frost scars where frost action has destroyed the organic surface mat and exposed the mineral soil; these scars comprise about 15 percent of this mapping unit.

Original Native (climax) Vegetation: This site has a tussock cottongrass appearance, but lichens dominate the plant composition. Barren frost scars characterize the site. The few shrubs are low.

Relative percent composition of total plant community:

	Percent composition by weight (air-dry) current year's growth[A/]	Season of use By animal [A/]
GRASSLIKES/GRASS	(25)	
Tussock cottongrass (Eriophorum vaginatum)	20	RSp MXS
Bigelow sedge (Carex bigelowii)	5	RSp RS MXS
Tall cottongrass (Eriophorum angustifolium), fescue (Festuca sp.), bluegrass (Poa alpigena), and bluejoint Calamagrostis canadensis) are minor components of the original native vegetation.		
SHRUBS	(30)	
Labrador tea (Ledum decumbens)	20	
Lowbush cranberry (Vaccinium vitis-idaea)	5	

	Percent composition by weight (air-dry) current year's growth[A/]	Season of use By animal [A/]
Blueberry (Vaccinium uliginosum)		RW
Dwarf birch (Betula nana)	5	RSp
Crowberry (Empetrum nigrum), netleaf willow (Salix reticulata), mountain heather (Cassiope tetragona), alpine bearberry (Arctostaphylos alpina), and diamondleaf willow (Salix planifolia) are minor parts of the original native vegetation.		
FORBS	(Trace)	
Wintergreen (Pyrola sp.), coltsfoot (Petasites frigida) meadow bistort (Polygonum bistorta), and cloudberry (Rubus chamaemorus) are minor components of the potential plant community.		
CRYPTOGAMS	(45)	
White branched lichen (Cladonia sp.)	30	RW
White tubular lichen (Cetraria cucullata)	10	RW
Brown prickly lichen (Cetraria islandica)	5	RW
Other types of lichen occur in minor amounts.		
TOTAL	100	

Total production for this site is approximately 1500 pounds of air-dry vegetation per acre in years with favorable growing conditions and 1250 pounds of air-dry production per acre in less favorable years. This is one of the most extensive range sites in the survey area, and has the greatest productivity of lichens. Therefore, it ranks at the top in importance for potential reindeer winter range. Approximately 80 percent of the total production of this site is from plants which potentially furnish preferred food for reindeer (50 percent winter/30 percent spring-summer).

If used by muskox, this site would be fair summer range. Approximately 25 percent of the total production, (current year's growth,) is from plants potentially used as summer food for muskox.

Under continued heavy reindeer grazing, lichen will decrease and such shrubs as Labrador tea, bearberry, and crowberry will increase. Rotational use of the range, especially in the winter, is necessary in commercial reindeer husbandry to provide protection to the resource. This cannot be accomplished without PROPER HERDING. Field trials of fertilization, chiseling tussocks, and evaluation of past burns may contribute to development of new management techniques.

A/ See Glossary.

If fire occurs, Bigelow sedge, cloudberry, dwarf birch, Labrador tea, and blueberry reoccur the first year. Production is 20 percent of normal. In the second and third year, Labrador tea predominates, and tussock cottongrass and lowbush cranberry appear when productivity to 60 percent of normal.

This site has a high potential for wildlife habitat. It is interspersed among BEACH DUNES, TIDAL MARSH, BRUSHY DRAINAGES, DRAINED LAKES, UPLAND WHITE SPRUCE ACID and ALKALINE ROCK DESERTS and their associated vegetation. This site provides habitat for ptarmigan, brown bear, wolf, muskox, bald eagle, golden eagle, ravens, and various birds.

IQ1 TIDAL MARSH (Histic Pergelic Cryaquepts)

This mapping unit occupies level tidal flats generally at the mouth of large rivers. About 25 percent of the area is composed of circular ponds. Histic Pergelic Cryaquepts in this mapping unit consist of poorly drained soils that have a well decomposed peaty surface mat, 8 to 16 inches thick, over very dark gray silt loam. There is no ice-rich permafrost within 26 inches of the base of the mat.

The soils have moderate permeability in the surface peaty mat, but, because they are always close to saturation, the intake rate of water is slow; both vertical and lateral water movement through the soil is slow. Plant roots are mostly in the upper peaty mat.

The vegetation is dominated by short growing sedge and creeping alkaligrass.

Representative profile of the Histic Pergelic Cryaquepts subgroup, NW¼ NW¼ of Section 5, T.6N., R.15W. (Stop No. 24)

O2	15-0"	Very dark grayish brown (2.5Y 3/2) well decomposed peat; many roots; medium acid; clear smooth boundary.
B21g	0-12"	Very dark gray (N 3/) silt loam; massive; slightly sticky, slightly plastic; neutral; abrupt smooth boundary.
B22g	12-15"	Dark grayish brown (2.5Y 4/2) silt loam; massive; slightly sticky, slightly plastic; neutral; abrupt smooth boundary.
Cg	15-26"	Dark gray (N 4/) silt loam; massive; slightly sticky, slightly plastic; no roots; neutral.

Mineral content of the peaty surface mat ranges from 5 to 30 percent. Texture of the B horizon ranges from fine sandy loam to silty clay loam.

Inclusions of other soils make up less than 20 percent of the area. These include mostly Pergelic Cryaquepts and small areas of the BEACH DUNES range site which occur as narrow strips along the coastline. The soils in these strips are Pergelic Cryopsamments.

Original Native (climax) Vegetation: This site always occurs in association with other sites and together they make up a mosaic pattern that is generally found at the mouths of large rivers draining into the ocean and flat basins adjacent to the sea. The vegetation is predominately low sedge (less than 30 cm tall and mostly averaging 15 cm tall) that is tolerant of salt water. The relative proportions of the several sites are:

Tidal Marsh	45%
Water - includes shallow lakes and channels, some of which contain marestail (Hippuris vulgaris)	25%
Beach Dunes	20%
Bare ground	10%

Relative percentage composition of the total plant community:

	Percent composition by weight (air-dry) current year's growth[A/]	Season of use by animal [A/]
GRASSLIKES/GRASS	(85)	
Hoppner sedge (Carex Ramenskii)	60	
Creeping alkaligrass (Puccinellia phryganodes)	20	
Arctic bluegrass (Poa arctica)	5	
Arctic rush (Juncus arcticus) is found in trace amounts in the original native vegetation.		
FORBS	(15)	
Common silverweek (Potentilla Egedii)	10	
Aster (Aster sp.)	5	
Arctic daisy (Chrysanthemum arcticum), Dock (Rumex sp.), and goosefoot (Chenopodium sp.) are found in trace amounts in the original native vegetation.		
TOTAL	100	

Total production for this site is approximately 1250 pounds of air-dry, vegetation per acre, current year's growth, in favorable years and 750 pounds in less favorable years.

Herders report that the reindeer actively seek out this site in early spring and again in late fall. This site is especially important for short periods. Herders believe the reindeer are searching for an essential nutrient, possibly related to salt water. [1/]

A/ See Glossary.
1/ Alfred Karmun, Deering, Alaska.

Most of the plant species on this site (and those species on the site's associated land forms) are potentially preferred food for reindeer.

Because of the tidal nature of this site, heavy grazing use is not potentially damaging. The grass-like plants (Hoppner sedge and creeping alkali grass) have a low growth form, making them well adapted to heavy grazing pressure. The site is subject to natural influences of much greater consequence than grazing intensity should impart.

This site is the first to become ice-free in the spring. Therefore, it is a critical "resting and feeding" area for geese and related water fowl during spring and fall migrations to and from Siberia and Arctic Alaska. This site furnishes excellent spring and fall feed for waterfowl. It is closely associated with LOW SHRUB, MIXED SHRUB, and SPARSE SHRUB TUSSOCK TUNDRA, and BRUSHY DRAINAGES range sites. It provides varied habitat for wolf, brown bear, ptarmigan, bald eagle, golden eagle, raven, waterfowl and shorebirds. Sheefish may inhabit the Buckland and Kiwalik River mouth areas.

IQ5 UPLAND MOUNTAIN MEADOW (Pergelic Cryaquepts)

This mapping unit occupies level to rolling broad ridges, upper valley slopes, and hillsides. Much of the area is characterized by frost scars and solifluction lobes. Pergelic Cryaquepts in this mapping unit consist of poorly drained soils formed in silty materials. They have a peaty surface mat about 5 inches thick over a mottled very dark gray silt loam. Ice-rich permafrost is about 10 inches below the base of the mat.

The soils have moderate permeability above the permafrost table, but, because they are always close to saturation, the intake rate of water is slow; both vertical and lateral water movement through the soil is slow. A large proportion of the annual precipitation is lost as surface runoff. Plant roots are mostly in the upper peaty mat; but some penetrate to the permafrost table.

Under undisturbed conditions there is slight or no erosion. Disruption of the peaty surface mat, however, can result in localized increased depth of thaw and, even on gentle slopes, severe gullying. The area has a "meadowy" appearance.

Representative profile of the Pergelic Cryaquepts subgroup, SE¼ NE¼ of Section 22, T.7N., R.17W. (Stop No. 22)

011	5-3"	Dark reddish brown (5YR 2/2) raw fibrous hypnum peat; many roots; very strongly acid; abrupt smooth boundary.
012	3-0"	Very dusky red (2.5YR 2/2) partly decomposed peat; many roots; very strongly acid; abrupt wavy boundary.

B2g 0-10" Very dark (N 3/) silt loam; many large prominent dark brown (7.5YR 4/4) mottles; weak medium and coarse subangular blocky structure; slightly sticky, slightly plastic; many roots; very strongly acid.

Cgf 10"+ Very dark gray (N 3/) silt loam (frozen 8/4/76)

The thickness of the surface organic mat ranges from 0 to 8 inches. A thin very dark A1 horizon may be present. Texture ranges from loam to silty clay loam, and percent gravel ranges from 0 to 35 percent. Depth to the permafrost table ranges from 5 to 20 inches.

Inclusions of other kinds of soil make up 5 to 15 percent of most mapping units. These include Histic Pergelic Cryaquepts, Pergelic Cryoborolls, Pergelic Cryofibrists, Pergelic Cryorthents, and Pergelic Cryumbrepts. Also included are small areas of frost scars where frost action has destroyed the surface organic mat and exposed the mineral soil.

Original Native (climax) Vegetation: Grasslike plants dominate the scene even though the shrubs are equal in percentage composition (by weight) with grasslikes. Plants and shrubs are quite inconspicuous because of their low, prostrate growth habit.

Relative percent composition of the total plant community:

	Percent composition by weight (air-dry) current year's growth A/	Season of use by animal A/
GRASSLIKES/GRASS	(40)	
Bigelow sedge (Carex bigelowii)	35	RS RF MXY
Sheathed sedge (Carex vaginata)		
Sedge (Carex nardina)	5	RS RF MXY
Tall cottongrass (Eriophorum angustifolium), tussock cottongrass (Eriophorum vaginatum), polargrass (Arctagrostis latifolia), bluegrass (Poa alpigena), and bluejoint (Calamagrostis canadensis) comprise minor parts of the original native vegetation.		
SHRUBS/SUB-SHRUBS	(40)	
Dwarf birch (Betula nana)	8	RSp MXY
Mountain avens (Dryas integrifolia)	7	RW RSp MXY
Netleaf willow (Salix reticulata)	5	RSp RS MXY
Diamondleaf willow (Salix planifolia)	5	RSp RS MXY
Arctic willow (Salix arctica torulosa)	5	RSp RS MXY
Skeletonleaf willow (Salix phlebophylla)		RSp RS MXY
Blueberry (Vaccinium uliginosum)		RW
Lowbush cranberry (Vaccinium Vitis-idaea)	10	
Labrador tea (Ledum decumbens)		MXW

	Percent composition by weight (air-dry) current year's growth[A]	Season of use by animal[A]
Alpine bearberry (Arctostaphylos alpina) and crowberry (Empetrum nigrum) are minor components of the original native shrub vegetation.		
FORBS	(Trace)	
Wintergreen (Pyrola sp.), mountain heather (Cassiope tetragona), mountain bitort (Polygonum bistorta), lousewort (Pedicularis sp.), cloudberry (Rubus chamaemorus), coltsfoot (Petasites frigida), two-flower cinquefoil (Potentilla biflora), saussurea (Saussurea angustifolia), Jacob's-ladder (Polemonium acutiflorum), spring beauty (Claytonia sp.) and some astragalus (Astragalus sp.) are in trace amounts in the original native herbaceous vegetation.		
CRYPTOGAMS	(20)	
Branched lichen (Cladonia sp.)	5	RW
Tubular lichen (Cetraria cucullata)	10	RW
Prickly lichen (Cetraria islandica)	5	RW
Other types of lichen and horsetail (Equisetum arvense) occur in minor amounts.		
TOTAL	100	

Total annual production for this site is approximately 1000 pounds of air-dry vegetation per acre in favorable years and 500 pounds in less favorable years.

Approximately 85 percent of the total production, current year's growth, is from plants potentially used as food for reindeer (30 percent in winter and 75 percent in summer).

During the summer, reindeer seek out this site because it is usually windy and provides relief from insects.

Under continued heavy grazing lichen will decrease and moss, alpine bearberry, Labrador tea, and crowberry will increase. If prolonged trampling is concentrated on a small area, all the vegetation will be destroyed; this may result in subsequent soil erosion.

Rotational use of the range, especially in winter, is necessary in commercial reindeer husbandry in order to provide protection to the resource. This cannot be accomplished without PROPER HERDING. Field

A/ See Glossary.

trials of fertilization, chiseling tussocks, and evaluation of past burns may contribute to development of new management techniques.

This site has a high potential for wildlife habitat because of its variety of plant species and its interspersion with associated sites (LOW SHRUB, MIXED SHRUB, and SPARSE SHRUB TUSSOCK TUNDRA, ACID and ALKALINE ROCK DESERT, DRAINED LAKE BORDERS, and ALLUVIAL TALL SHRUB). It provides habitat, for ptarmigan, brown bear, wolf, muskox, bald eagle, golden eagle, raven, and other birds.

IU2 UPLAND WHITE SPRUCE (Pergelic Cryumbrepts - Pergelic Cryoborolls Association)

This mapping unit occupies undulating to hilly ridges and slopes and is made up of about 50 to 75 percent Pergelic Cryumbrepts and 25 to 50 percent Pergelic Cryoborolls. Vegetation consisting of white spruce with an understory of sedges, grasses, forbs, and shrubs is interrupted by bare frost scars, stone stripes, and gravelly step formations.

The soils have moderate permeability. There are many roots in the upper 6 inches. The concentration of roots decreases to a depth of 12 to 14 inches, below which there are none.

Pergelic Cryumbrepts in this mapping unit consist of well-drained soils that have a peaty surface mat about 4 inches thick over a very dark grayish brown silt loam A11 horizon, a mottled dark brown silt loam A12 horizon, and a dark yellowish brown very gravelly silt loam C horizon. These soils formed in material derived from basalt, granite, or micaceous schist.

Representative profile of the Pergelic Cryumbrepts subgroup, SE¼ NE¼ of Section 16, T.12N., R.16 W. (Stop No. 33)

O1	4-2"	Very dusky red (2.5YR 2/2) partly decomposed peat; many roots; abrupt wavy boundary.
O2	2-0"	Black (N 2/) well decomposed peat; very strongly acid; abrupt wavy boundary.
A11	0-2"	Very dark grayish brown (10YR 3/2) silt loam; weak medium and fine subangular blocky structure; very friable, slightly sticky, slightly plastic; many roots; medium acid; abrupt wavy boundary.
A12	2-12"	Dark brown (10YR 3/3) silt loam; many large prominent reddish brown (5YR 4/4) and common large prominent gray (5Y 5/1) mottles; weak medium subangular blocky structure; friable, slightly sticky, slightly plastic; common roots; medium acid; abrupt wavy boundary.

C 12-24" Dark yellowish brown (10YR 4/6) very gravelly silt loam; massive; friable, slightly sticky, slightly plastic; slightly acid.

Pergelic Cryoborolls in this mapping unit consist of well-drained silty and gravelly soils that formed in materials from limestone, marble, and micaceous schist. They have a thin peaty surface mat about 1 inch thick over a dark reddish brown silt loam upper horizon, and a dark olive gravelly silt loam that becomes more gravelly with depth. Calcareous micaceous schist fragments make up more than 50 percent of the underlying C horizon; lime accumulates on the undersides of the fragments.

Representative profile of the Pergelic Cryoborolls subgroup, NW¼ NE¼ of Section 21, T.2N, R.6W. (Stop No. 56)

Included in this mapping unit are about 5 to 10 percent bare frost scars, stone stripes, and gravelly step formations. Also included are small areas of Histic Pergelic Cryaquepts, Pergelic Cryaquepts, and Pergelic Cryorthents.

O1 6-4" Black (2.5YR 2/) partially decomposed peat; many roots; neutral; abrupt wavy boundary.

O2 4-0" Black (10YR 2/1) well decomposed peat; many roots; neutral; abrupt irriegular boundary.

A1 0-3" Very dark grayish brown (2.5Y 3/2) silt loam; weak medium and fine subangular blocky structure; very friable, slightly sticky, slightly plastic; common roots; neutral; clear wavy boundary.

B2 3-20" Dark olive gray (5Y 3/2) very gravelly silty clay loam; moderate medium subangular blocky structure; friable, slightly sticky, slightly plastic; few roots; neutral.

Original Native (climax) Vegetation: The vegetation is a white spruce woodland community with a mixed understory of forbs, shrubs, and cryptogams.

Relative percent composition of the "understory" plant community when the overstory canopy is about 50 percent aerial coverage:

	Percent composition by weight (air-dry) current year's growth A/	Season of use by animal A/
GRASS/GRASSLIKES	(5)	
Siberian Fescue (Festuca altaica)		
Bigelow sedge (Carex bigelowii)	5	RS MS MW

A/ See Glossary.

	Percent composition by weight (air-dry) current year's growth[A/]	Season of use by animal [A/]
Other sedges (Carex sp.), woodrush (Luzula multiflora), arctic rush (Juncus arctica) and fescue (Festuca altaica) are minor components of the original native vegetation.		
FORBS	(10)	
Arctic lupine (Lupinus arcticus)	5	
Senecio (Senecio pauperculus)		
Alpine sweet-vetch (Hedysarum alpinum)	5	
Milk vetch (Astragalus sp.)		
Arnica (Arnica Lessingii), saussurea (Saussurea angustifolia), northern larkspur (Delphinium brachycentrum), coltsfoot (Petasites frigidus), lousewort (Pedicularis sp.), false asphodel (Tofieldia pussila), meadow rue (Thalictrum sp.), mountain bistort (Polygonum bistorta), Indian paintbrush (Castilleja sp.), alpine sweet vetch (Hedysarum alpinum), astragalus (Astragalus sp.), and lupine (Lupinus sp.) are minor components of the original native vegetation.		
SHRUBS/SUB-SHRUBS	(55)	
White mountain avens (Dryas octopetala)	10	RW
Blueberry (Vaccinium uliginosum)	10	
Dwarf birch (Betula nana exilis)	5	RW RSp RS MS MW
Grayleaf willow (Salix glauca)	5	RSp RS MW MS
Diamondleaf willow (Salix planifolia)	5	RSp RS MW MS
Entireleaf mountain avens (Dryas integrifolia)	5	RW
Bearberry (Arctostaphylos rubra)	5	
American green alder (Alnus crispa)	5	MW
Fourangle mountain heather (Cassiope tetragona)		
Lowbush cranberry (Vaccinium vitis-idaea)	5	MW
Shrubby cinquefoil (Potentilla fruticosa		
Crowberry (Empetrum nigrum), glandular birch (Betula glandulosa), Labrador tea, (Ledum decumbens, and Netleaf Willow (Salix reticulata), are minor components of the shrub community.		
CRYPTOGAMS	(30)	
White or purple branched lichen (Cladonia sp.)	15	RW
Cauliflower lichen (Stereocaulon ap.)	5	RW
White tubular lichen (Cetraria cucullata)	5	RW MW
Brown prickly lichen (Cetraria islandica)	5	RW MW

	Percent composition by weight (air-dry) current year's growth[A/]	Season of use by animal [A/]
Meadow horsetail (Equisetum arvense) is a minor component of the original native vegetation.		
TOTAL	100	

TREES
White spruce (Picea glauca) (Overstory canopy + 50 percent aerial coverage)
Woodland production potential at 3" Diameter:
- Number of trees per acre - 170
- Basal area per acre - 10 sq. ft.

Arboreal lichens are abundant on the branches of white spruce. Scotter (1962) and Edwards, et al. (1960) consider arboreal lichens to be an important source of winter feed for caribou.

This site produces 1000 pounds per acre air-dry vegetation annually; 750 pounds per acre in less favorable years; and 1250 pounds per acre in more favorable years.

This is one of the most important reindeer winter ranges in the survey area. Herders are hesitant to encourage use of this site due to predation. Reindeer are harcer to keep track of on timbered range.

Approximately 70 percent of the current year's growth of understory is from plants potentially used as reindeer food (60 percent in winter and 30 percent in spring-summer). At least half the current year's growth of understory is from plants potentially used as moose food (50 percent in winter and 20 percent in summer).

Overuse of this site will cause a decrease in lichens and an increase in moss, bearberry, crowberry and Labrador tea, thus degrading the winter range.

Rotational use of the range, especially in winter, is necessary if reindeer husbandry is to develop with proper use of the range resource. This cannot be accomplished without PROPER HERDING.

This site has a high potential for wildlife habitat because of its abundance and variety of vegetation. It is associated with the LOW SHRUB, MIXED SHRUB, and SPARSE SHRUB TUSSOCK TUNDRA, DRAINED LAKE BORDERS, BRUSHY DRAINAGES, ALLUVIAL TALL SHRUB, and ALLUVIAL MIXED FOREST SITES. It is valuable habitat for ptarmigan, hare, fox, red squirrel, lynx, ermine, and marten. Wolf, brown bear, and moose also inhabit the site.

NUTRITIONAL VALUE OF FORAGE BY RANGE SITES

Plant samples originally collected for production purposes were analyzed with three major objectives in mind.

1) Compare the relative nutritional index of range sites by analyzing a common species. Blueberry (Vaccinium uliginosum) was sampled on more range sites than any other species and was selected as the indicator plant.

2) Analyze the dominant grass or grass-like plants from each range site to compare relative differences of nutrition available to herbivores.

3) Analyze soils to determine the effect of soil differences on the nutritive value of plants.

Table 3 shows a comparison of total nitrogen from the soil mapping units with each other as well as that of blueberry (Vaccinium uliginosum), a common species. Soil nitrogen shows extreme variability ranging from .195 percent to 2.13 percent in the organic fraction and from .127 percent to 2.32 percent in root bearing mineral horizons. Blueberry by contrast varies from 1.58 percent to 2.41 percent nitrogen. Table 3 indicates there is much more variability between soils of different sites than there are among plant samples of common species growing on those soils.

Table 4 shows the same pattern for total phosphorus that Table 3 shows for nitrogen. The ratio between total nitrogen and total phosphorus in the soil is good; about 1:10. By comparing the nutritional requirements for cattle and sheep (Table 6) with analysis of the plant tissue samples (Table 5) one could assume that nitrogen is sufficient on all sites for the production of animals. Phosphorus on the other hand is the limiting nutrient for animals. Apparently there is sufficient total phosphorus in the soil system but that portion available for plant growth is low; the balance is probably tied up in the organic fraction of the soils. Table 7 gives the analysis of selected soil samples.

Table 6 shows the nutritional requirements for cattle and sheep. Much remains to be learned about what these requirements are for reindeer. Elements other than phosphorus seem to be sufficient for all forage species except lichens, which typically are low in everything.

In Table 8 plant production, species composition, and nutrient analysis are used to compare production of crude protein/acre on separate kinds of range. Comparing separate range sites supporting different species is like comparing apples and oranges. Nevertheless, crude protein produced per acre is a common denominator and is the best way to compare different range types. Because of limited data, Table 8 doesn't reflect the amount of forage available to herbivores.

TABLE 3. PERCENT NITROGEN OF SOIL AND RANGE MAPPING UNITS.

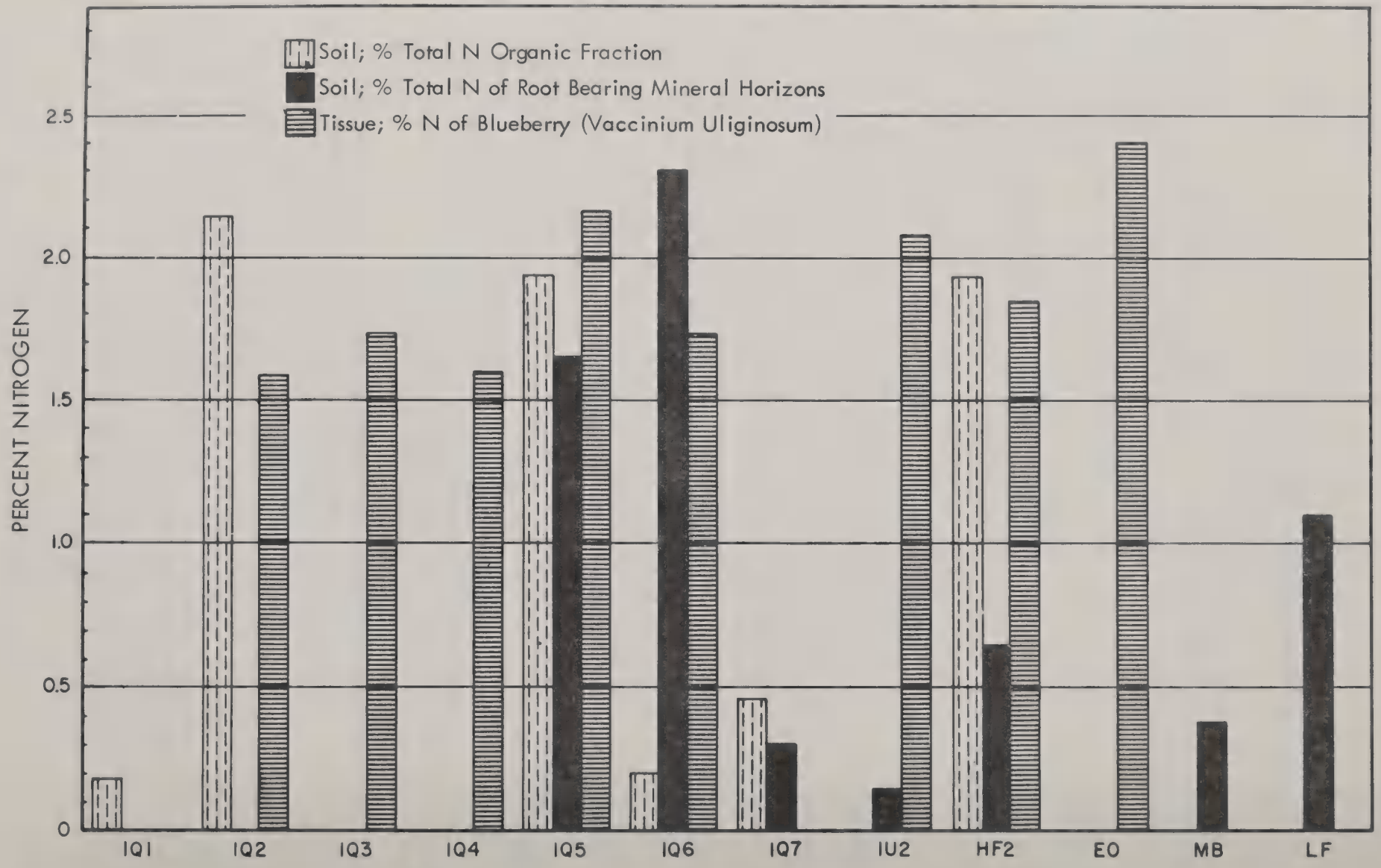

TABLE 4. PERCENT PHOSPHORUS OF SOIL AND RANGE MAPPING UNITS.

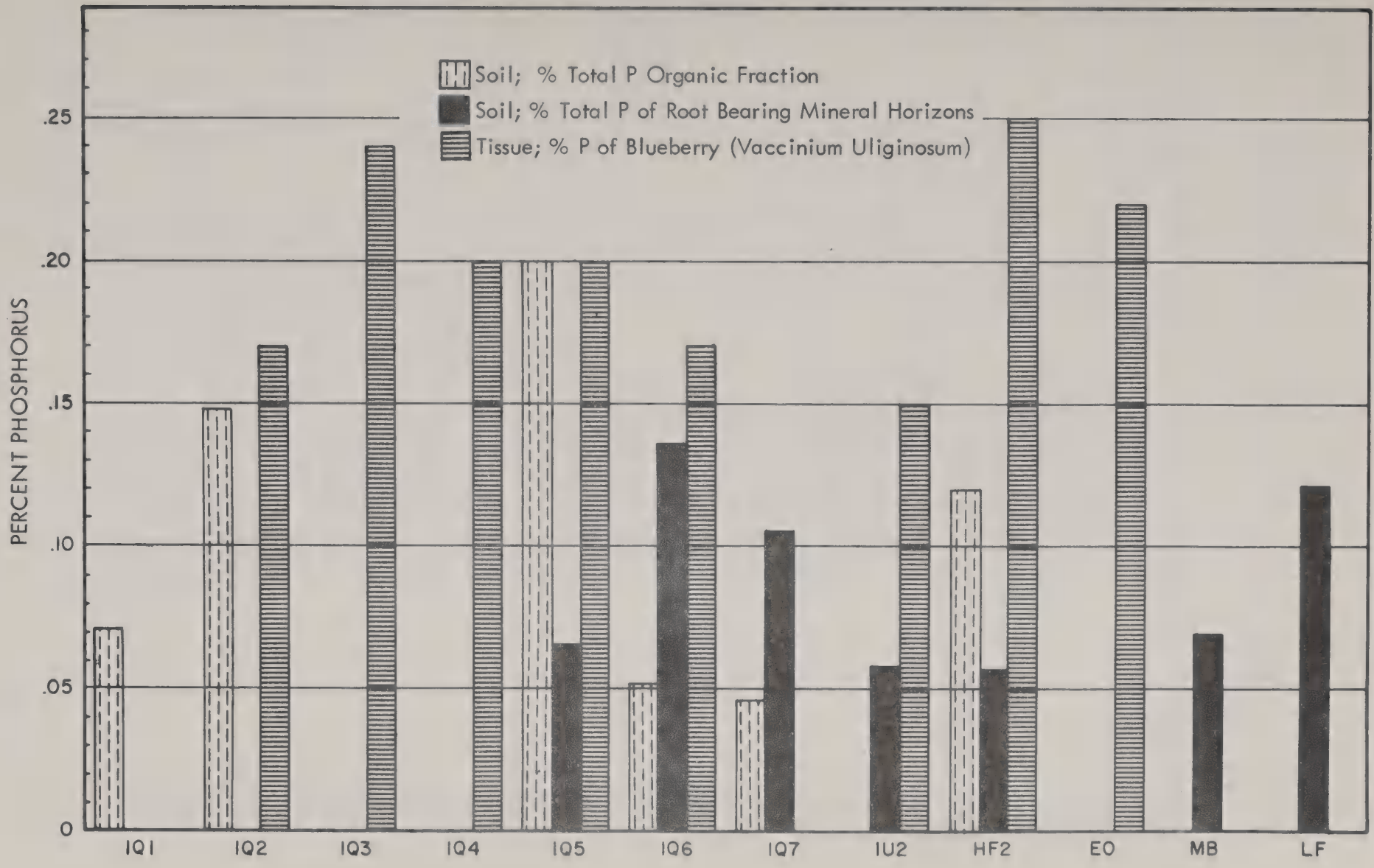

TABLE 5. Analysis of Selected Plant Tissue Samples. (Sampled July and August, 1976.)

Map Symbol	Site Acquisition Number	Species	%N	%P	%K	%Ca	%Mg	% Crude Protein
IQ1	24	Carex ramenskii	2.18	.16	2.1	.36	.49	13.6
IQ1	24	Puccinellia phyganodes	2.05	.19	1.6	.51	.49	12.8
IQ1	24	Elymus mollis	1.65	.16	1.9	.34	.34	10.3
IQ2	21	Eriophorum vaginatum	1.00	.11	.47	.18	.11	6.25
IQ2	21	Vaccinium uliginosum	1.58	.17	.62	.52	.31	9.9
IQ2	21	Carex bigelowii	2.24	.18	1.6	.26	.33	14.0
IQ2	49	Rubus chamaemorus	2.60	.23	.75	.95	1.0	16.25
IQ2	42	Ledum decumbens	1.40	.18	.53	.63	.21	8.75
IQ2	58	Betula nana	1.73	.33	.50	.63	.42	10.8
IQ2	30	Alectoria	.57	.12	.33	.17	.29	3.6
IQ2	18	Cladonia uncialis	.44	.12	.27	.19	.31	2.8
IQ3	54	Eriophorum vaginatum	1.18	.16	.58	.21	.36	7.4
IQ3	48	Vaccinium uliginosum	1.73	.24	.67	.65	.20	10.8
IQ4	61	Eriophorum vaginatum	1.50	.19	.52	.29	.23	9.4
IQ4	61	Vaccinium uliginosum	1.60	.20	.56	.54	.31	10.0
IQ4	57	Ledum decumbens	1.87	.24	.74	.55	.25	11.7
IQ4	57	Alnus crispa	2.26	.31	.70	.78	.33	14.1
IQ4	16	Empetrum nigrum	1.17	.18	.53	.70	.28	7.3
IQ4	34	Vaccinium vitis	.77	.13	.38	.73	.26	4.8
IQ4	37	Cladonia alpestris	.81	.12	.23	.34	.15	5.0
IQ4	51	Cetraria cucullata	.48	.15	.35	.29	.20	3.0
IQ5	22	Carex bigelowii	2.38	.20	1.7	.58	.26	14.9
IQ5	22	Vaccinium uliginosum	2.16	.20	.88	.53	.20	13.5
IQ6	19	Carex bigelowii	1.58	.13	.80	.85	.17	9.9
IQ6	19	Eriophorum vaginatum	1.93	.13	1.1	.73	.34	12.0
IQ6	10	Petasites frigidus	2.43	.31	4.4	1.9	.55	15.2
IQ6	19	Vaccinium uliginosum	1.73	.17	.77	1.1	.27	10.8
IQ6	41	Spiraea beauverdiana	2.17	.18	.80	.55	.20	13.6
IQ6	41	Salix planifolia	2.15	.17	.57	.79	.33	13.4
IQ7	32	Calamagrostis canadensis	2.27	.14	1.4	.39	.20	14.2
IU2	56	Carex bigelowii	2.05	.17	1.2	1.2	.34	12.8
IU2	33	Vaccinium uliginosum	2.07	.15	.52	.91	.29	12.9
IU2	56	Betula glandulosa	1.75	.17	.97	.76	.38	10.9
HF1	71	Carex aquatilis	1.50	.18	.74	.68	.18	9.4
HF2	23	Carex aquatilis	1.22	.16	.74	.36	.23	7.6
HF2	23	Eriophorum vaginatum	1.07	.14	.47	.20	.13	6.7
HF2	68	Carex rotundata	1.52	.19	.77	.37	.11	9.5
HF2	4B	Vaccinium uliginosum	1.85	.25	1.1	.39	.19	11.6
EO	53	Calamagrostis canadensis	1.59	.17	1.4	.45	.25	9.9
EO	53	Vaccinium uliginosum	2.41	.22	1.5	.70	.23	15.0
MB	26	Carex nardina	1.16	.11	.71	1.3	.16	7.3
MB	26	Dryas integrifolia	1.28	.13	.52	3.0	.19	8.0
MB	6	Salix arctica	2.75	.21	1.8	2.2	.26	17.2

Table 6. Nutritional Requirements of Domestic Animals*.

	% N	% P	% K	% Ca	% Mg
Lactating Beef Cow	1-1.5	.18-.22	.6-.8	.21-.26	.18
Sheep 180 lb. Ewe with 8 week old sucking twins	.5-1.2	.24-.37	.5	.25-.52	.06

*Nutrient requirements of domestic animals 5th Revision, 1976, National Research Council, National Academy of Sciences, Washington, D.C., Beef p. 56, Sheep p. 72.

Table 7. Analysis of Selected Soil Samples.

Mapping Unit Symbol	Soil Sample	pH	Total Amount Present - In Percent ppm-N NH_4	ppm-M NO_3	ppm-P	ppm-K	ppm-Ca	ppm-Mg	Total N	Total P
HF2	Histic Pergelic Cryaquepts 011 horizon 9-6" fibric peat	4.34		18.2	---	---	---	---	1.930	.120
HF2	Histic Pergelic Cryaquepts Cgf horizon 2-4" silt loam	5.08	26.3	4.6	1.9	332.5	1,762	391	.650	.058
HF1	Histic Pergelic Cryaquepts 02 horizon 15-0" sapric peat	4.89	7.2	5.3	8.3	684.0	814	588	.166	.071
IQ1	Histic Pergelic Cryaquepts B21g horizon 0-12" silt loam	7.43	7.8	36.0	14.0	684.0	6,090	77	.530	.069
IQ2	Histic Pergelic Cryaquepts 012 horizon 7-0" hemic peat	4.38	31.2	11.3	1.5	532.0	1,226	372	2.130	.148
IQ2	Histic Pergelic Cryaquepts A1 horizon 0-2" silt loam	5.27	17.0	110.0	1.2	199.5	2,848	374	.800	.103
IQ2	Histic Pergelic Cryaquepts B2g horizon 2-4" silt loam	4.00	44.8	6.5	1.0	95.0	398	165	.324	.03
IQ5	Pergelic Cryaquepts 102 horizon 3-0" hemic peat	5.57	76.6	10.9	0.2	988.0	5,315	473	1.950	.201
IQ4	Pergelic Cryaquepts B2g horizon 0-10" silt loam	5.14	14.2	4.9	0.8	199.5	432	58	1.640	.065
IQ6	Pergelic Cryaquepts 02 horizon 4-0" sapric peat	6.37	7.3	5.7	0.6	294.5	3,107	133	.195	.052

Table 7. Analysis of Selected Soil Samples.

Mapping Unit Symbol	Soil Sample	pH	Total Amount Present - In Percent ppm-N NH_4	ppm-M NO_3	ppm-P	ppm-K	ppm-Ca	ppm-Mg	Total N	Total P
IQ6	Pergelic Cryaquepts B2g horizon 0-24" silt loam	6.36	25.2	20.4	0.7	1,178.0	14,237	363	2.320	.134
IQ7	Pergelic Cryaquepts 02 horizon 5-0" sapric peat	4.76	36.9	5.3	0.1	323.0	331	144	.449	.044
IQ7	Pergelic Cryaquepts B2g horizon 2-16" silt loam	6.29	32.4	19.3	1.3	389.5	2,513	473	.296	.104
IU2	Pergelic Cryoborolls A1 horizon 0-3" silt loam	7.63	4.4	9.2	12.0	133.0	1,283	20	.127	.058
LF	Basalt lava flow sample of brown sandy loam (Entisol) in pockets	5.63	71.0	95.0	14.5	1,301.5	1,264	1,986	1.100	.122
MB	Pergelic Cryoborolls A11 horizon 0-5" silt loam	6.35	14.7	15.3	0.4	475.0	410	91	.367	.069
MB	Pergelic Cryoborolls C1 horizon 14-18" very gravelly silt loam	7.76	6.4	7.2	11.0	266.0	4,766	76	.200	.063

Table 8 Annual production of crude protein from dominant grass and grass-like plants on selected range sites of the Kotzebue Sound Area.

Species	% Plant Composition By Weight	Annual Production Lbs/Acre	-------Analysis--------- % Nitrogen	% Crude Protein	Species Annual Production Lbs Crude Protein/Acre	Annual Production Crude Protein Total Lbs/Acre from Grass and Grass-like Plants
EO ALLUVIAL MIXED FOREST (750 Lbs/Acre Understory Production)						
Calamagrostis canadensis	20	150	1.59	9.9	14.9	15
HF1 DRAINED LAKES (750 Lbs/Acre Annual Production)						
Carex aquatilis	75	563	1.50	9.4	52.9	---
Other grass-likes	20	150	----	----	----	
HF2 DRAINED LAKE BORDERS (500 Lbs/Acre Annual Production)						
Carex aquatilis	60	300	1.22	7.6	22.8	30
Carex rotundata	15	75	1.52	9.5	7.1	
IQ1 TIDAL MARSH (1000 Lbs/Acre Total Annual Production)						
Carex ramenskii	60	600	2.18	13.6	81.6	107
Puccinellia phyganodes	20	200	2.15	12.8	25.6	
IQ2 LOW SHRUB TUSSOCK TUNDRA (1125 Lbs/Acre Annual Production)						
Eriophorum vaginatum	15	169	1.00	6.25	10.6	34
Carex bigelowii	15	169	2.24	14.0	23.7	
IQ3 SPARSE SHRUB TUSSOCK TUNDRA (1375 Lbs/Acre Annual Production)						
Eriophorum vaginatum	20	275	1.18	7.4	20.4	---
Carex bigelowii	5	69	----	----	----	

Table 8 Annual production of crude protein from dominant grass and grass-like plants on selected range sites of the Kotzebue Sound Area.

Species	% Plant Composition By Weight	Annual Production Lbs/Acre	-------Analysis--------- % Nitrogen	% Crude Protein	Species Annual Production Lbs Crude Protein/Acre	Annual Production Crude Protein Total Lbs/Acre from Grass and Grass-like Plants
IQ4 MIXED SHRUB TUSSOCK TUNDRA (1375 Lbs/Acre Annual Production)						
Eriophorum vaginatum	15	206	1.5	9.4	19.4	—
Carex bigelowii	15	206	----	----	----	
IQ5 UPLAND MOUNTAIN MEADOW (1000 Lbs/Acre Annual Production)						
Carex bigelowii	35	350	2.38	14.9	39.2	39
IQ6 BRUSHY DRAINAGES (1375 Lbs/Acre Annual Production)						
Carex bigelowii	15	206	1.58	9.9	20.4	29
Eriophorum vaginatum	5	69	1.93	12.0	8.3	
IQ7 ALLUVIAL TALL SHRUB (2500 Lbs/Acre Annual Production)						
Calamagrostis canadensis	5	125	2.27	14.2	17.8	18
IU ACID ROCK DESERT (1000 Lbs/Acre Annual Production)						
No. Samples						
Carex, Sp.	5	25	----	----	----	---
IU2 UPLAND WHITE SPRUCE (1000 Lbs/Acre)						
Carex bigelowii	2	20	2.05	12.8	2.6	---
Festuca altaica	3	---	----	----	----	---
LF LAVA BEDS (500 Lbs/Acre Annual Production)						
Grass and grass-likes	Trace	----	----	----	----	---
MB ALKALINE ROCK DESERT (500 Lbs/Acre Annual Production)						
Carex bigelowii	10	50	----	----	----	---
Carex nardina	5	25	1.16	7.3	1.8	

SNOW COVER ON WINTER RANGE*

The winter snowpack is one of the principal factors in the overall reindeer environment. An intensive management plan will ultimately have to address the effect the snow cover has in limiting forage availability during critical winter months. A snow measurement program has been initiated to evaluate the extent to which the snow cover inhibits use of the total range.

Measurement points were established in August 1976 along three transects in the upper Kugruk River basin between Imuruk Lake and Independence. The transects run perpendicular to prominent ridges, traversing from the valley on one side over the top of the ridge to the valley on the other side. The ridges are oriented in different directions, one north-south, one east-west, and the other northwest to southeast. All are fairly free of other wind-influencing terrain in their near vicinity. This configuration provides slopes facing all major directions for evaluation of the various wind-induced effects.

The transects were visited during mid-March, 1977. The principal survey instrument used was a RAM Penetrometer. This instrument delineates the location, thickness and relative hardness in pounds of resistance of the various layers within the snow profile. Numerous RAM soundings were made on each aspect along the transects.

In general terms, it was determined that 9 pounds resistance is about the lower limit of snow firmness that will support a man's weight without snowshoes. Doug Sheldon, reindeer herder and member of the survey party, observed that a crust of 9 pounds resistance would pose no problem to the foraging herd. However, he observed reindeer would not attempt to utilize an area overlain by a snow crust of about 17 pounds resistance unless the animals were suffering extreme hunger. Whether they could survive if they had to under such conditions is unknown.

At the other extreme, snow layers with resistance of 30 pounds are very hard and represent conditions under which reindeer could certainly not survive even if they could "paw" through the crust.

The data from the 1977 survey presented a very interesting picture for the upper Kugruk basin. All south facing slopes and ridge tops had multiple snow layers of at least 30 pounds resistance or greater. Resistance on north-facing slopes was generally no greater than 9 pounds. The remaining valleys and east and west slopes are somewhere in between. Snow depth at every sampling point was within the range of 14 to 28 inches.

*Author of this section is George P. Clagett, snow survey supervisor for the USDA, Soil Conservation Service, Alaska.

It is not the intent at this time to present all the data or draw conclusions, but to describe the survey technique. It is believed that by continuing this annual survey and expanding it to a broader area and variety of conditions, it will be possible to develop management guidelines, based on the limiting factor of the snow cover.

ENGINEERING USES OF SOILS

The information in this section, together with the range sites and soil maps, can be used in a general way to determine soil conditions of significance in engineering and construction. It is important to recognize that this does not limit the need for detailed investigations at the site of any proposed construction.

Estimated Physical and Chemical Properties of the Soils

Table 9 gives the U.S. Department of Agriculture textural classification and the probable engineering classification of each major soil horizon, and estimates of some physical and chemical properties of the soils that are significant in engineering.

Many engineers classify soil materials in accordance with the system of the American Association of State Highway Officials (AASHO) (2). In this system, soil materials are classified in seven principal groups. The groups range from A-1, consisting of gravelly soils of high bearing capacity, to A-7, consisting of clay soils having low strength when wet, and A-8, consisting of organic soils. Other engineers use the Unified Soil Classification System (9). In this system soil materials are identified as coarse grained (8 classes), fine grained (6 classes), or highly organic.

Both classification systems are explained in the PCA Soil Primer (7), and in standard textbooks on soil mechanics.

Engineering Interpretations of Soil Properties

Table 10 contains estimates of suitability of the soils as a foundation or as a source of construction materials and lists by degrees and kind some limiting factors that may affect the use of soils for specified purposes. Some of the major engineering problems and practices are discussed below.

Roadfill (highway subgrade material).

Roadfill is soil material removed from its original location and used as borrow for road subgrades. In general, the most desirable material is gravel, or gravel mixed with a moderate amount of sand. Loamy soils are less desirable, but may be used. Fine-grained and organic soils are usually unsatisfactory. Soils with a high permafrost table, water perched above the permafrost, and a high natural moisture content usually are difficult to excavate and handle.

Table 9. Soils of the Kotzebue Sound Area, Alaska and their Estimated Physical and Chemical Properties.

Map Symbol	Soil Name	Depth from Surface (typical profile) (inches)	USDA[1] Texture	Unified	AASHO	Permeability[2] (in/hr)	Depth to High Water Table (feet)	Reaction pH
EO	Pergelic Cryorthents	0-9	sil	ML	A-4	0.6-2.0	> 6	6.1-6.5
		9-17	sl	SM	A-2	2.0-6.0		5.6-6.0
		17-30	vgls	GP	A-1	6.0-20		-------
HF1	Pergelic Cryofibrists	0-15	pt	Pt	A-8	> 6.0	< 1	4.5-5.0
		15+	pt	Pt	A-8	Permafrost		-------
HF2	Pergelic Cryofibrists (60-80 percent of mapping unit)	0-18	pt	Pt	A-8	> 6.0		4.0
		18+	pt	Pt	A-8	Permafrost	< 1	4.0
	Histic Pergelic Cryqauepts (20-40 percent of mapping unit)	9-0	pt	Pt	A-8	0.6->6.0	< 1	4.0-5.0
		0-2	sil	ML	A-4	0.6-2.0		5.1-5.5
		2+	sil	ML	A-4	Permafrost		-------
IQ1	Histic Pergelic Cryaquepts	15-0	pt	Pt	A-8	0.2-6.0	< 1	5.6-6.0
		0-26	sil	ML	A-4	0.06-0.2		6.6-7.3
IQ2	Histic Pergelic Cryaquepts	11-0	pt	Pt	A-8	0.6->6.0	< 1	4.0
		0-4	sil	ML	A-4	0.6-2.0		5.1-5.5
		4+	sil	ML	A-4	Permafrost		-------
IQ3	Histic Pergelic Cryaquepts	13-0	pt	Pt	A-8	0.6->6.0	< 1	4.0
		0-5	sil	ML	A-4	Permafrost		5.1-5.5
IQ4	Histic Pergelic Cryaquepts	13-0	pt	Pt	A-8	0.6->6.0	< 1	4.0
		0-10	sil	ML	A-4	Permafrost		4.0
IQ5	Pergelic Cryaquepts	5-0	pt	Pt	A-8	0.6->6.0	< 1	4.5-5.0
		0-10	sil	ML	A-4	0.6-2.0		4.5-5.0
		10+	sil	ML	A-4	Permafrost		
IQ6	Pergelic Cryaquepts	6-0	pt	Pt	A-8	0.2->6.0	< 1	4.0
		0-24	sil	ML	A-4	0.6-2.0		5.6-6.0
		24+	sil	ML	A-4	Permafrost		-------
IQ7	Pergelic Cryaquepts	7-0	pt	Pt	A-8	0.2->6.0	< 1	4.5-5.0
		0-16	sil	ML	A-4	0.6-2.0		6.1-6.5
		16+	sil	ML	A-4	Permafrost		-------

Table 9. Continued:

Map Symbol	Soil Name	Depth from Surface (typical profile) (inches)	USDA[1/] Texture	Unified	AASHO	Permeability[2/] (in/hr)	Depth to High Water Table (feet)	Reaction pH
IU1	Rubble land (80-90 percent of unit)		Consists of granitic stones and boulders					
	Pergelic Cryumbrepts	1-0	pt	Pt	A-8	0.2-6.0		4.0
	(10-20 percent of unit)	0-10	vgsl	GM	A-2	0.6-6.0	>6	4.0-5.5
IU2	Pergelic Cryumbrepts	4-0	pt	Pt	A-8	0.2-6.0	>6	4.5-5.0
	(50-75 percent of unit)	0-12	sil	ML	A-4	0.6-2.0		5.6-6.0
		12-24	vgsil	GM	A-2	0.6-2.0		6.1-6.5
	Pergelic Cryoborolls	6-0	pt	Pt	A-8	0.2-6.0		6.6-7.3
	(25-50 percent of unit)	0-3	sil	ML	A-4	0.6-2.0	>6	6.6-7.3
		3-20	vgsil	GM	A-2	0.6-2.0		6.6-7.3
LF	Lava Flows - Entisols Association		(About 90 to 95 percent black lava rock.)					
MB	Pergelic Cryoborolls	1-0	pt	Pt	A-8	0.2-6.0	>6	-------
		0-5	sil	ML	A-4	0.6-2.0		7.4-7.8
		5-14	gsil	ML	A-4	0.6-2.0		7.4-7.8
		14-18	vgsil	GM	A-2	0.6-2.0		7.4-7.8

1/ Explanation of symbols: gsil - gravelly silt loam; pt - peat; sil - silt loam; sl - sandy loam; vgls - very gravelly loamy sand; vgsil - very gravelly silt loam;

2/ Permeability is for soil without compaction; for wet soils, the permeability is that to be expected after removal of free water.

Soils in coarse alluvial sand and gravel are the best sources of roadfill. These are the Pergelic Cryorthents (EO), which are estimated to be a good source of gravel.

Sand and Gravel.

For use in concrete or as a road subbase, sand and gravel should be nearly free of fine-grained materials and organic matter.

The Pergelic Cryorthents (EO) are the best sources of sand and gravel in the area.

Potential Frost Action.

Frost action in soils is a major problem in the Area. Frost susceptibility ratings in Table 10 depend largely on the texture of the soil material and the internal soil drainage. The poorly drained silty soils and the peaty soils are rated as having "high" potential frost action. The well-drained Pergelic Cryoborolls (MB), Pergelic Cryorthents (EO), and Pergelic Cryumbrepts (part of IU2) are considered to have moderate susceptibility to frost action.

Roads and Streets.

It is assumed in evaluating soils for use in place as a foundation for roads that the subsoil will remain undisturbed. The best soils for this use are well-drained, have high bearing strength, and have low frost action potential.

Most soils in the area have severe limitations as road sites. The Pergelic Cryorthents (EO) are most desirable for this use. Areas of this soil which are adjacent to streams, however, are exposed to erosion during high stream runoff. Most of the soils in the area consist of peaty and silty materials and have high permafrost tables and perched water above the permafrost. Roads can be constructed on these soils only if insulation usually in form of high gravel embankments is provided beneath the road to prevent thawing during the summer. The Histic Pergelic Cryaquepts of mapping unit IQ1 are occasionally inundated by high tides. They are not well suited for roads. The Pergelic Cryoborolls (MB) and Pergelic Cryumbrepts (of unit IU2) have moderate to severe limitations for this use.

Foundations for low buildings.

The suitability of soils as foundations for low buildings in the area depends largely on their bearing strength and their susceptibility to frost action. Perennially frozen ground, as long as it remains frozen, has high bearing strength, but if it is allowed to thaw its bearing strength is very low. On most soils of the area, serious damage to low buildings as a result of uneven settling of foundations can be avoided only by construction methods which maintain the existing permafrost

Table 10. Engineering Interpretations of Soil Properties.

Map Symbol	Suitability as source of Roadfill	Sand and Gravel	Soil Limitation Ratings[1] and Major Limiting Factors Affecting[2] Potential Frost Action	Roads & Streets	Foundations for low Buildings	Remarks
EO	Good	Poor for sand; good for gravel	Moderate (6)	Moderate (5,6,7)	Severe (5)	Stratified silty and sandy soils over gravel; occurs on floodplains
HF1	Poor (2,3,4,7)	Unsuited (4)	High (2,4)	Severe (2,3,4,7)	Severe (2,3,4,7)	Very poorly drained peaty soils over permafrost at a shallow depth; drained lakes.
HF2	Poor (2,3,4,7)	Unsuited (4,6)	High (2,4,6)	Severe (2,3,4,7)	Severe (2,3,4,7)	Association of very poorly drained peaty soil and poorly drained soils with a peaty surface layer over silty materials.
IQ1	Poor (1,2,4,7)	Unsuited (4,6)	High (2,4,6)	Severe (1,2,3,4,7)	Severe (1,2,3,4,7)	Poorly drained soils with a peaty surface layer over silty materials; on tidal flats.
IQ2	Poor (2,3,4,7)	Unsuited (4,6)	High (2,4,6)	Severe (2,3,4,7)	Severe (2,3,4,7)	Poorly drained soils with a peaty surface layer over silty materials; on uplands.
IQ3	Poor (2,3,4,7)	Unsuited (4,6)	High (2,4,6)	Severe (2,3,4,7)	Severe (2,3,4,7)	Poorly drained soils with a peaty surface layer over silty materials; on uplands.
IQ4	Poor (2,3,4,7)	Unsuited (4,6)	High (2,4,6)	Severe (2,3,4,7)	Severe (2,3,4,7)	Poorly drained soils with a peaty surface layer over silty materials; on uplands.

Table 10. Continued.

Map Symbol	Suitability as source of Roadfill	Sand and Gravel	Potential Frost Action	Soil Limitation Ratings1/ and Major Limiting Factors Affecting 2/ Roads & Streets	Foundations for low Buildings	Remarks
IQ5	Poor (2,3,4,7,)	Unsuited (4,6)	High (2,4,6)	Severe (2,3,4,7)	Severe (2,3,4,7)	Poorly drained soils with a thin peaty surface layer over silty materials; on uplands.
IQ6	Poor (2,3,4,7)	Unsuited (4,6)	High (2,4,6)	Severe (2,3,4,7)	Severe (2,3,4,7)	Poorly drained soils with a thin peaty surface layer over silty materials; adjacent to drainageways on uplands.
IQ7	Poor (2,3,4,7)	Unsuited (4,6)	High (2,4,6)	Severe (2,3,4,5,7)	Severe (2,3,4,5,7)	Poorly drained soils with a thin peaty surface layer over silty materials; on floodplains.
	Poor (9)	Unsuited (9)	Low (9)	Severe (9)	Severe (9)	About 80 to 90 percent Rubble land
IU1	Fair (6,7,8)	Unsuited for sand; poor for gravel.	Moderate (6)	Moderate to severe depending on slope. (6,7,8)	Moderate to severe depending on slope. (7,8)	About 10 to 20 percent Pergelic Cryumbrepts. Well drained soils on hills.
	Fair (6,7,8)	Unsuited for sand; poor for gravel	Moderate (6)	Moderate to severe depending on slope. (6,7,8)	Moderate to severe depending on slope. (7,8)	About 50 to 75 percent Pergelic Cryumbrepts. Well drained soils on hills.
IU2	Fair (6,7,8)	Unsuited for sand; poor for gravel	Moderate (6)	Moderate to severe depending on slope. (6,7,8)	Moderate to severe depending on slope. (7,8)	About 25 to 50 percent Pergelic Cryoborolls. Well drained soils on hills.

Table 10. Continued.

Map Symbol	Suitability as source of Roadfill	Sand and Gravel	Potential Frost Action	Soil Limitation Ratings 1/ and Major Limiting Factors Affecting 2/ Roads & Streets	Foundations for low Buildings	Remarks
LF	(About 90 to 95 percent black lava rock on level valley floor.)					
MB	Fair (6,7,8)	Unsuited for sand; poor for gravel	Moderate (6)	Moderate to severe depending on slope. (6,7,8)	Moderate to severe depending on slope. (7,8)	Well drained soils on hills.

1/ Soil limitations ratings: Slight - The soil limitations, if any, are easy to overcome.
Moderate - Soil limitations need to be recognized, but can be overcome by good planning, careful design, and proper construction.
Severe - Soil limitations ordinarily are not economically feasible to overcome.

2/ Number in parentheses refers to major soil limiting factors considered in the rating:
1. Susceptible to inundation by high tides.
2. High water table.
3. High permafrost table.
4. Organic material.
5. Seasonal stream overflow.
6. Presence of silty material.
7. Frost potential.
8. Steep or rough terrain.
9. Large stones.

level. The most common method is to construct buildings on pilings imbedded in the permafrost, with an air space provided between the ground and the insulated floor of the building.

The Pergelic Cryorthents (EO) have, in general, the fewest limitations for low buildings, but even on these well-drained soils the possibility of ice-rich permafrost at some depth makes preconstruction investigation necessary. Also, protection is required against stream erosion and stream overflow. The Histic Pergelic Cryaquepts of mapping unit IQ1 are poor construction sites because they are occasionally inundated by high tides, have organic and silty soil materials, and have a ground water table within one foot of the soil surface.

Note: The soils in the BEACH DUNES range site (Pergelic Cryopsamments), although subject to ocean storms, are generally well suited to engineering uses. These soils were too small in area to delineate on the range sites and soils map, and are only mentioned as an inclusion in some mapping units.

FORMATION AND CLASSIFICATION OF THE SOILS

The soil is a natural, three dimensional body occurring on the surface of the earth. It contains living matter and supports or is capable of supporting plants. Its characteristics at any one point result from the combined influence of climate, living matter, parent materials, relief, and time, plus the effects of the cultural environment and man's use of the soil.

The entire area, with the exception of the alluvial sandy and gravelly sediments (Pergelic Cryorthents) that border the rivers, and the beaches (Pergelic Cryopsamments) bordering Kotzebue Sound, is underlain by permafrost. Most of the soils are wet throughout the summer because of the impermeable frozen substratum. This, and the low rate of decomposition of organic matter, has resulted in the development of a peaty mat on the soil surface. In the soils that are almost constantly wet, gleyed horizons have developed in the active layer above the permafrost table. In coarse textured soils with good drainage there are thin dark A horizons, but no other distinct soil horizons have formed. Soil temperatures at some depth in these soils are constantly below the freezing point, though they may not be rich in ice.

Most soils in the area have patterned ground features characteristic of soils of tundra areas. Polygons have developed in level to moderately sloping areas, and striped patterns have formed in steeper areas. In the well drained Pergelic Cryumbrepts and Pergelic Cryoborolls textural sorting has resulted in thicker gravel surface layers in barren zones between vegetated strips on hillsides. Many high knolls are almost barren. Long narrow pressure ridges have developed in level Histic Pergelic Cryaquepts, Pergelic Cryaquepts, and Pergelic Cryofibrists.

Solifluction patterns are visible in sloping areas of these soils. Bare frost scars occur in some of the Histic Pergelic Cryaquepts and Pergelic Cryaquepts.

The classification of the soils of the Kotzebue Sound area according to the U. S. Department of Agriculture Soil Taxonomy is given in Table 11. Definitions and descriptions of the classes in each category are given by the Soil Survey Staff (8).

Table 11. Classification of Soil Subgroups of the Kotzebue Sound Area According to the Soil Taxonomy of the United States Department of Agriculture (8).

Map Symbol	Order	Suborder	Great Group and Subgroup
EO	Entisols	Orthents	Pergelic Cryorthents
HF1	Histosols	Fibrists	Pergelic Cryofibrists
HF2	Histosols	Fibrists	Pergelic Cryofibrists
	Inceptisols	Aquepts	Histic Pergelic Cryaquepts
IQ2	Inceptisols	Aquepts	Histic Pergelic Cryaquepts
IQ3	Inceptisols	Aquepts	Histic Pergelic Cryaquepts
IQ4	Inceptisols	Aquepts	Histic Pergelic Cryaquepts
IQ5	Inceptisols	Aquepts	Pergelic Cryaquepts
IQ6	Inceptisols	Aquepts	Pergelic Cryaquepts
IQ7	Inceptisols	Aquepts	Pergelic Cryaquepts
IU1	Inceptisols	Umbrepts	Pergelic Cryumbrepts
	(In association with Rubble land)		
IU2	Inceptisols	Umbrepts	Pergelic Cryumbrepts
	Mollisols	Borolls	Pergelic Cryoborolls
LF	Entisols Association		(About 90 to 95 percent black lava rock)
MB	Mollisols	Borolls	Pergelic Cryoborolls

GLOSSARY

A. The percent composition by weight (air-dry current year's growth for lichen is that portion of the lichen showing no decay (not current year's growth for lichen.)

B. Within the range site descriptions the percent production of plants potentially furnishing food does not reflect management that will sustain the forage resource.

C. Key to Season of use by species

RW	Reindeer winter forage
RSp	Reindeer spring forage
RS	Reindeer summer forage
RF	Reindeer fall forage
MXW	Muskox winter forage
MXS	Muskox summer (spring, summer, fall) forage
MXY	Muskox yearlong forage
MW	Moose winter forage
MS	Moose summer (spring, summer, fall) forage

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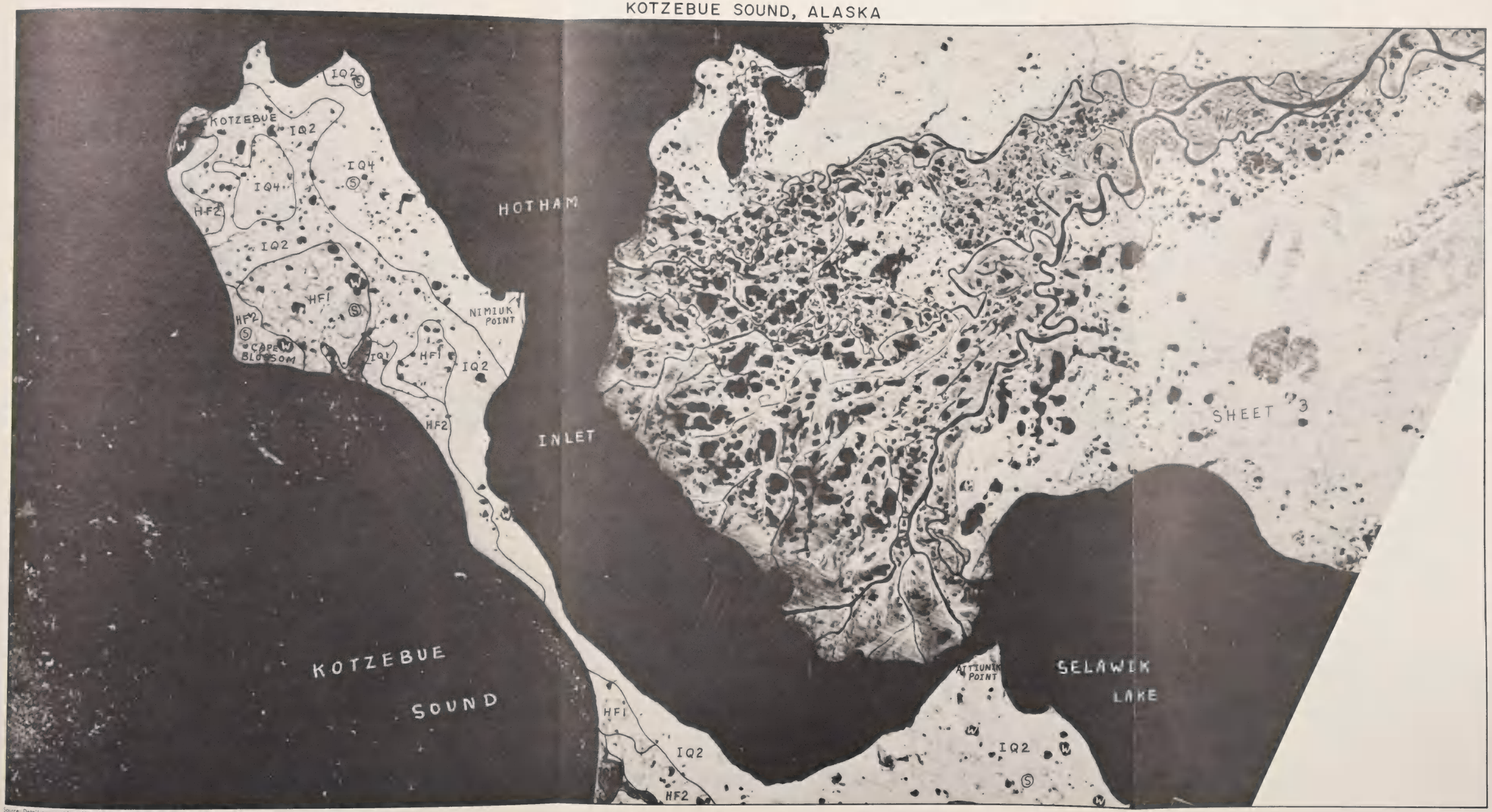

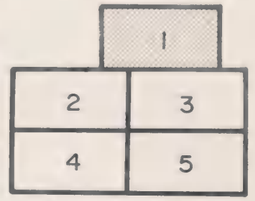

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RANGE SITES AND SOILS

- (W) Lake or Pond
- (IQ2) Soil Line and Symbol
- (S) Range and Soil Sampling Site

Source: Detail prepared by USDA Soil Conservation Service in cooperation with the University of Alaska, Agricultural Experiment Station and Geophysical Institute.

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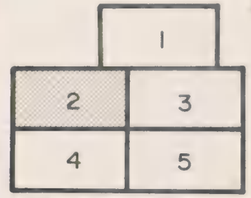

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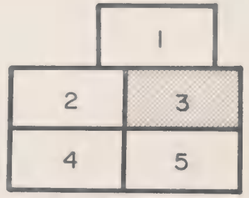

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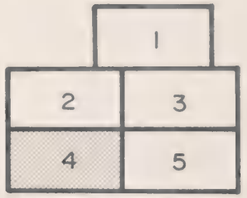

RANGE SITES AND SOILS

- (W) Lake or Pond
- (IQ2) Soil Line and Symbol
- (S) Range and Soil Sampling Site

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KOTZEBUE SOUND, ALASKA

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RANGE SITES AND SOILS

- (W) Lake or Pond
- (IQ2) Soil Line and Symbol
- (S) Range and Soil Sampling Site

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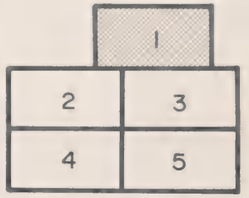

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AREAS MOST SUITABLE FOR USE BY REINDEER

- Spring
- Summer
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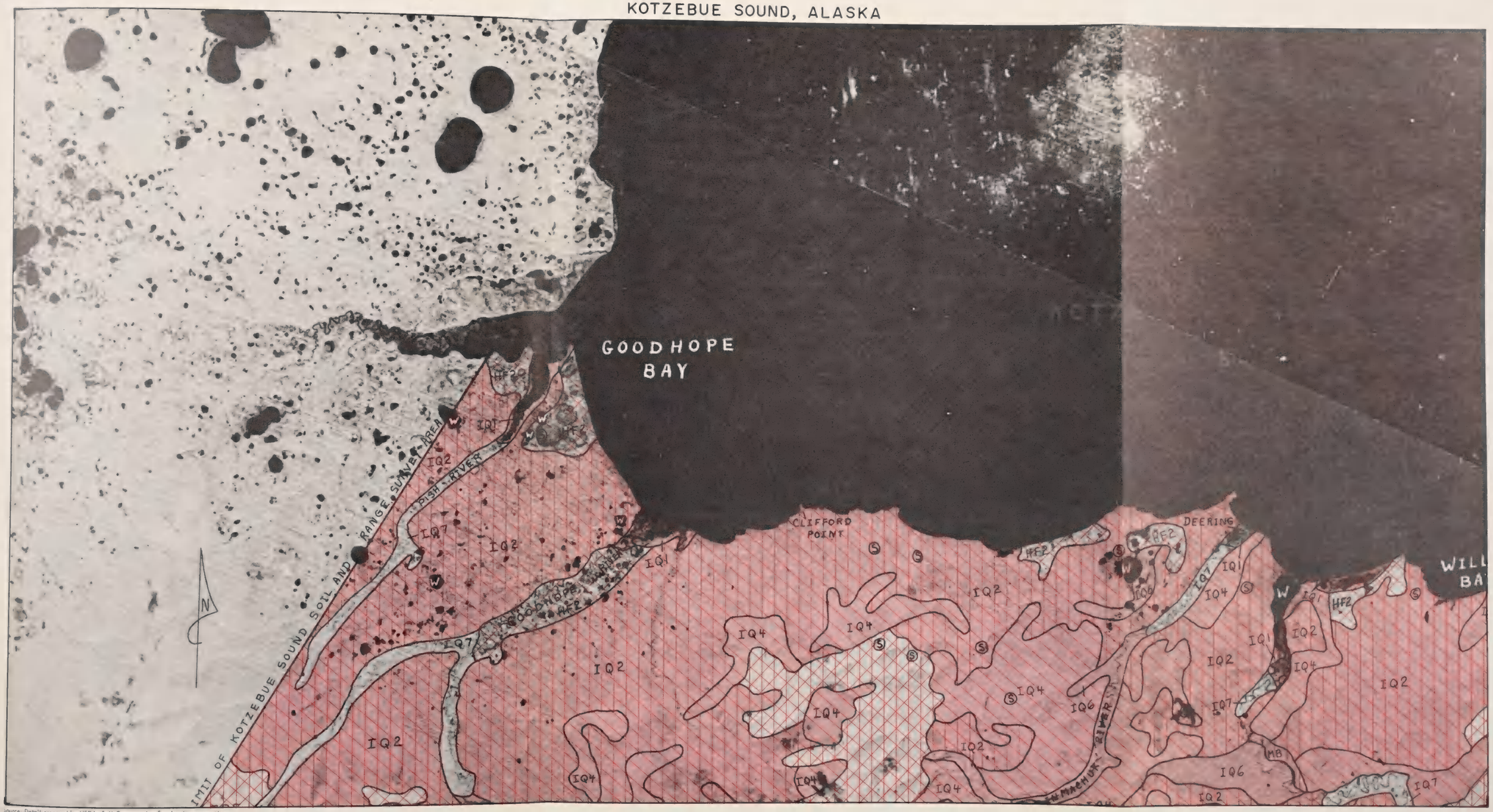

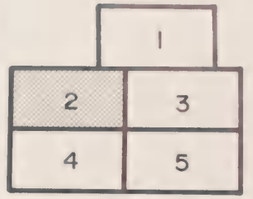

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AREAS MOST SUITABLE FOR USE BY REINDEER

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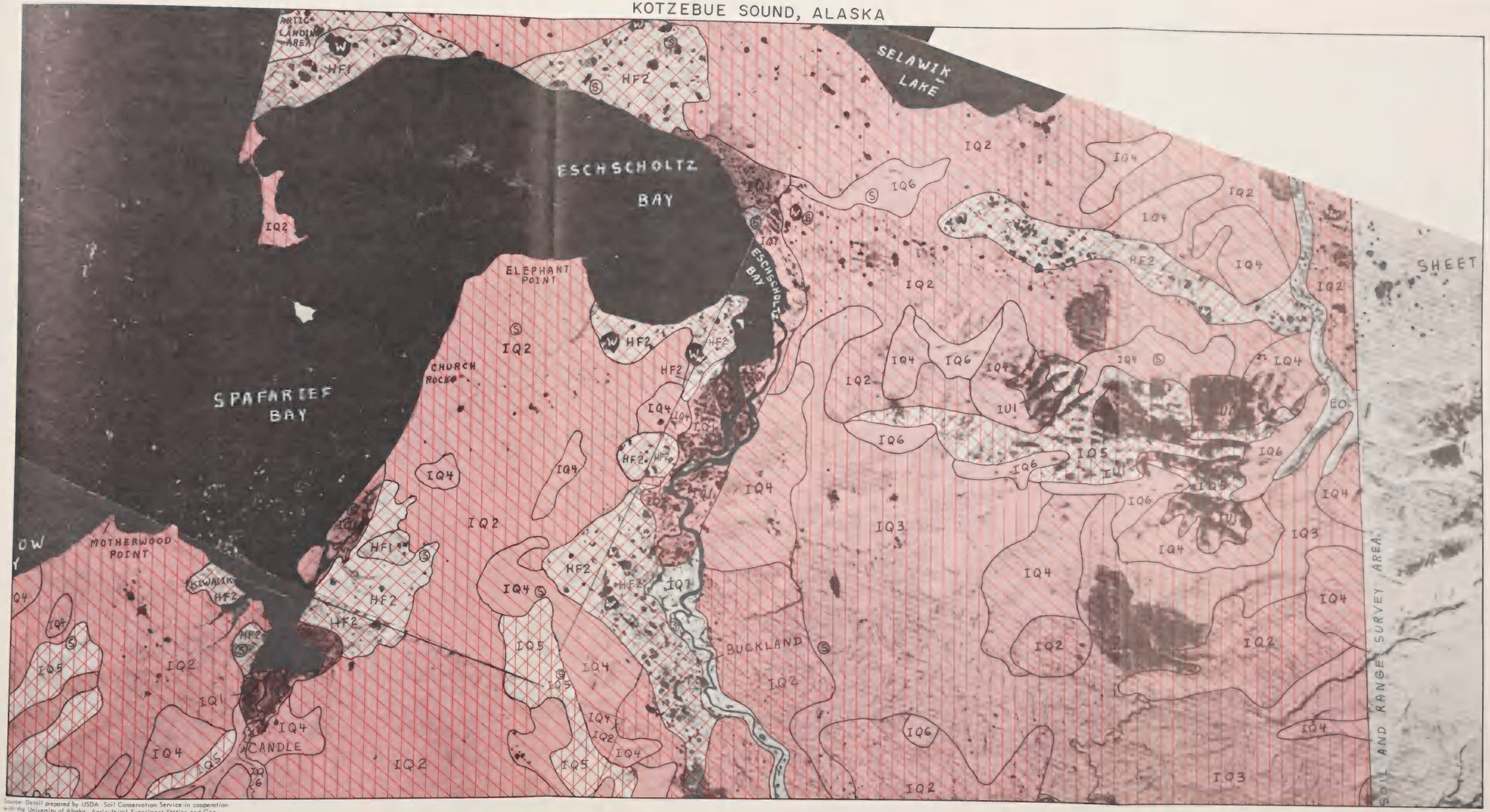

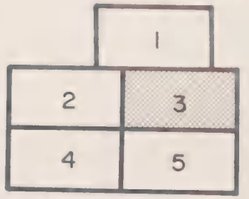

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AREAS MOST SUITABLE FOR USE BY REINDEER

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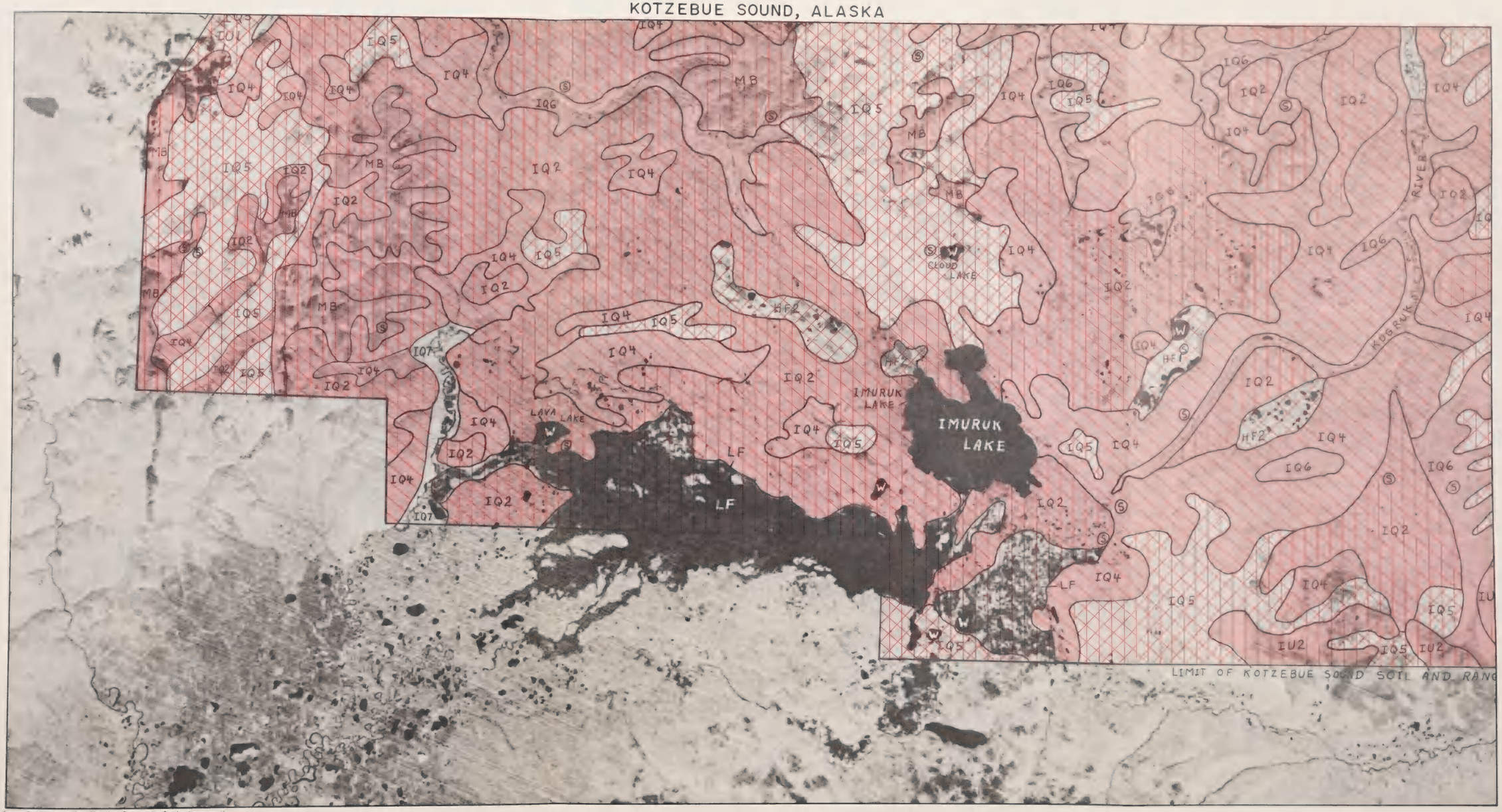

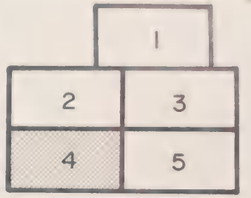

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AREAS MOST SUITABLE FOR USE BY REINDEER

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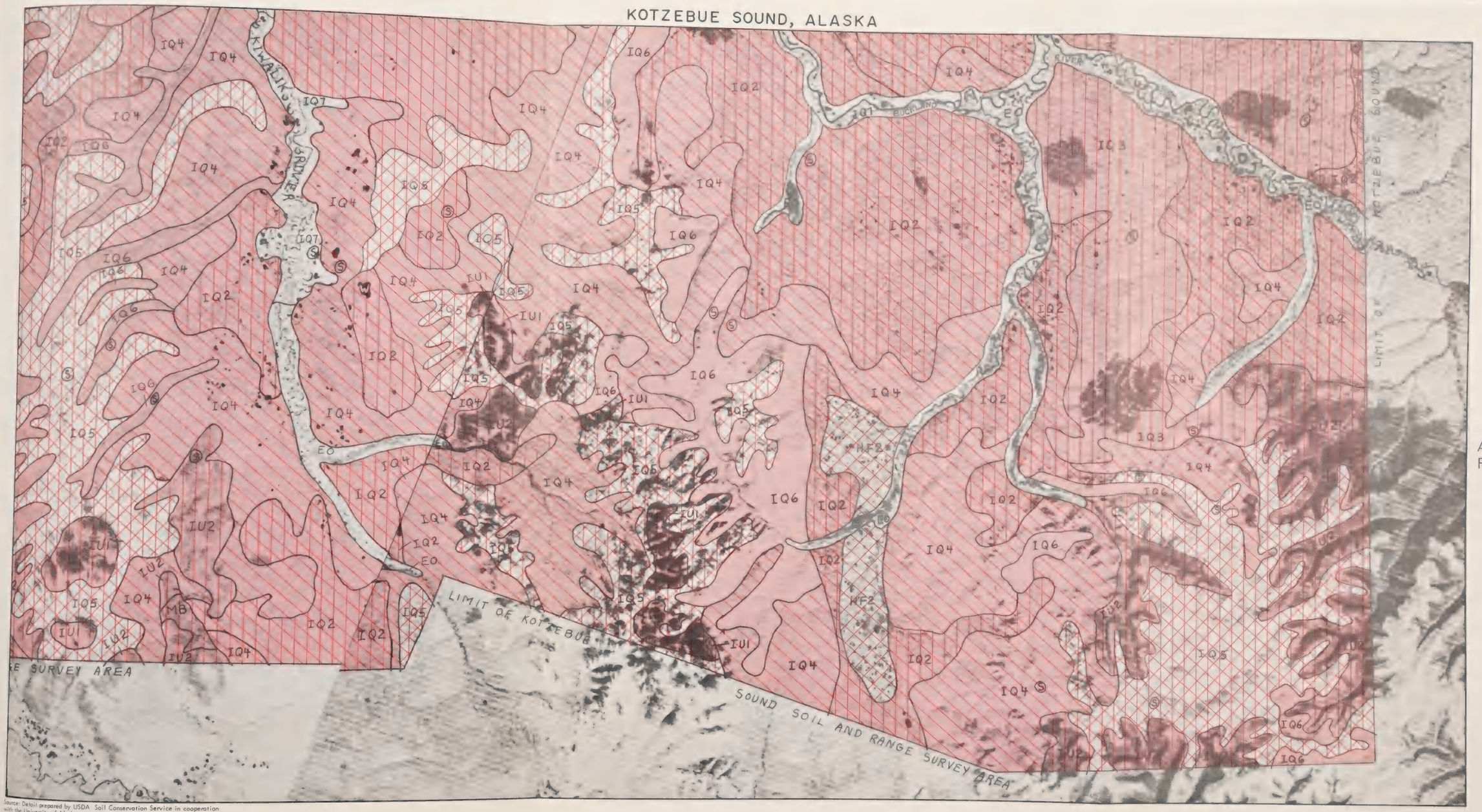

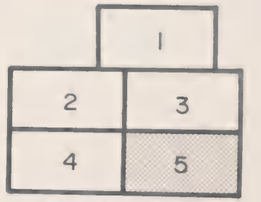

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AREAS MOST SUITABLE FOR USE BY REINDEER

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- Summer
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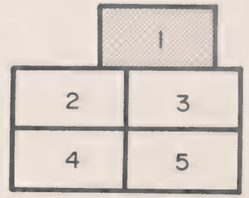

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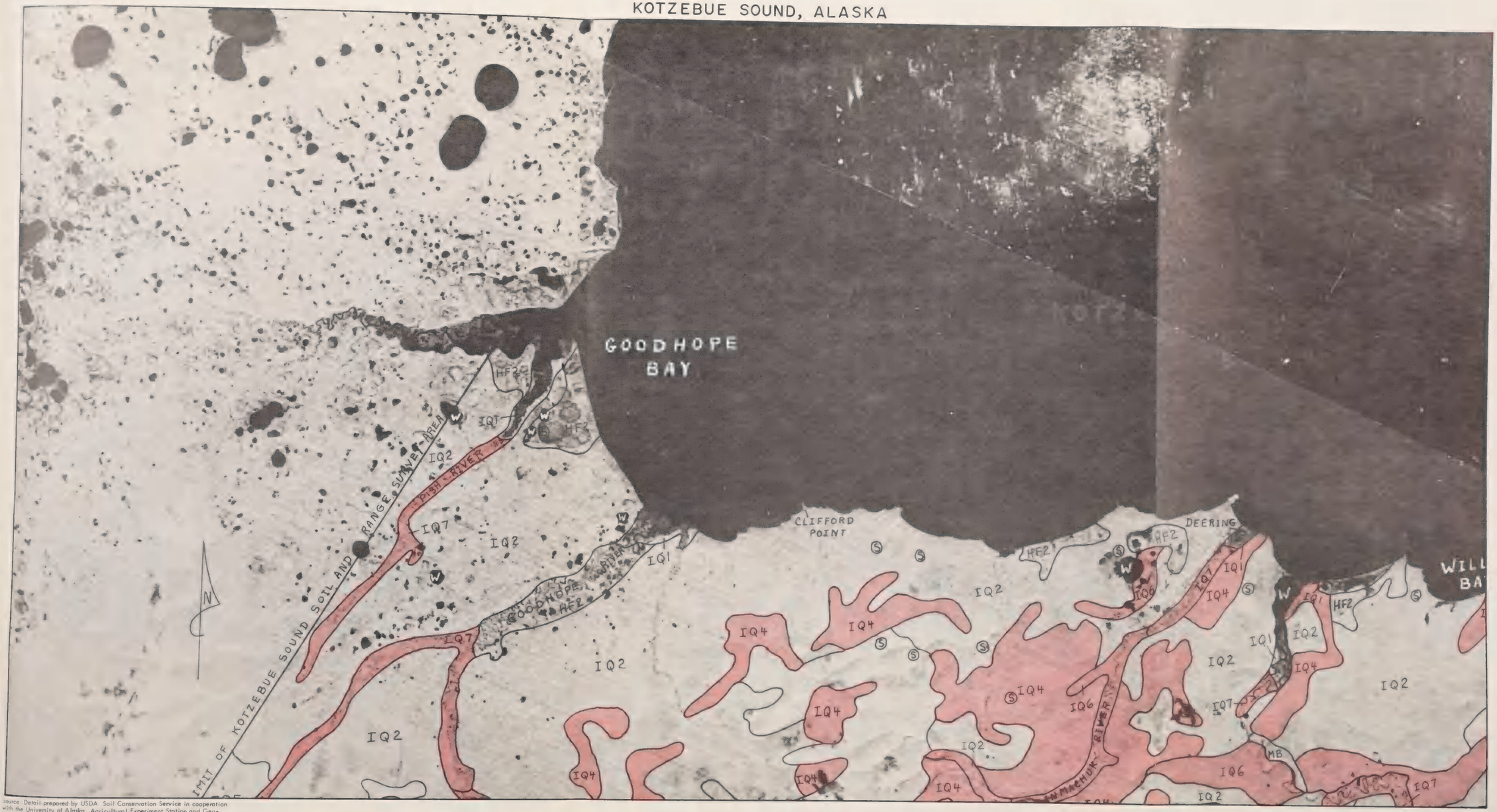

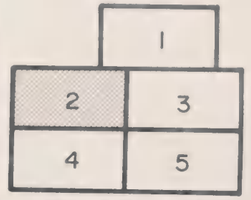

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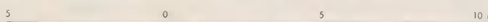

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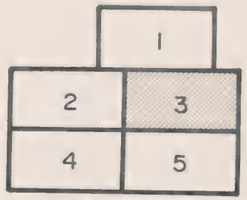

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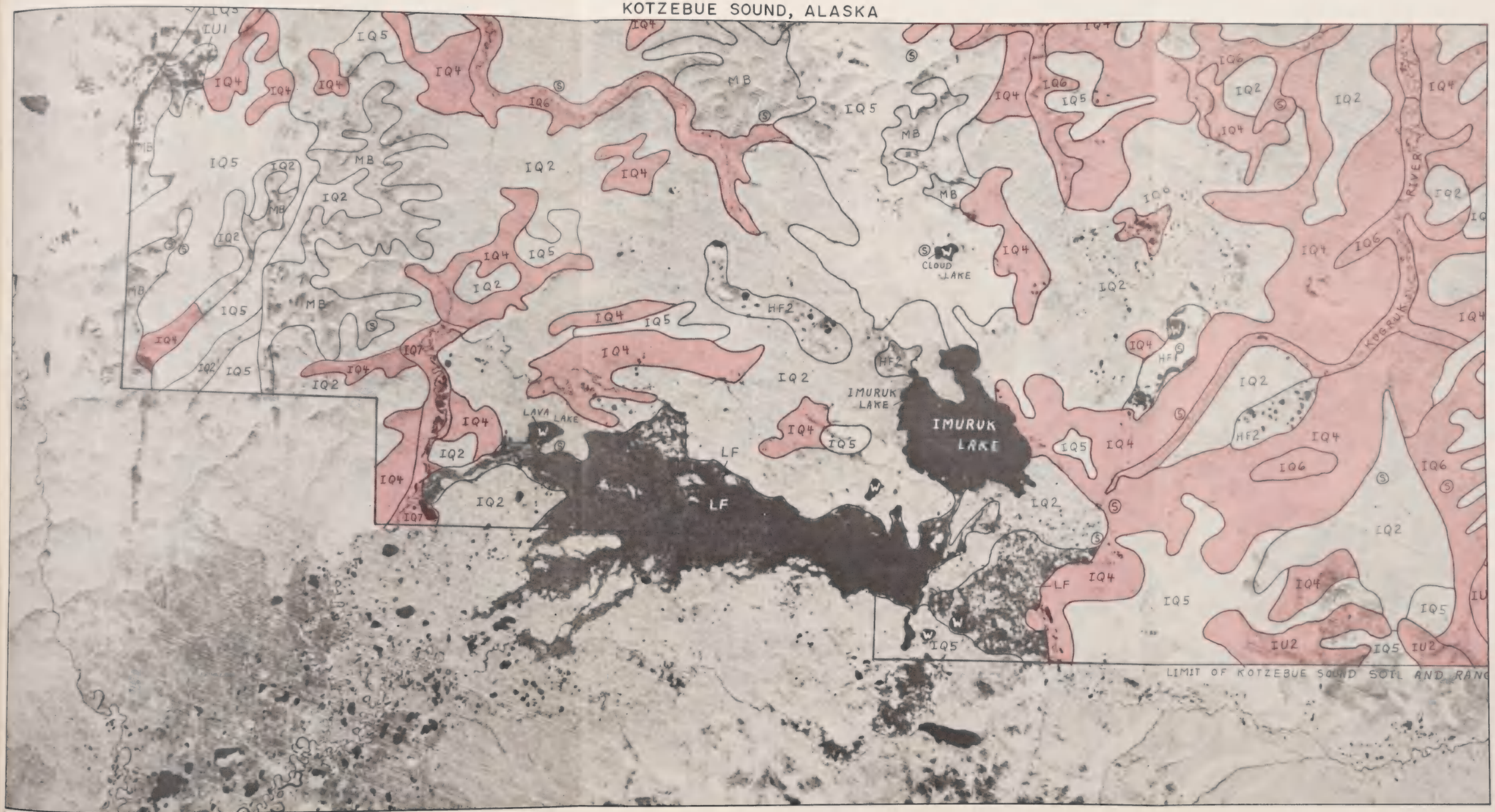

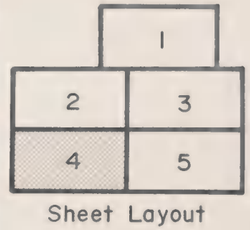

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AREAS MOST SUITABLE FOR USE BY MOOSE

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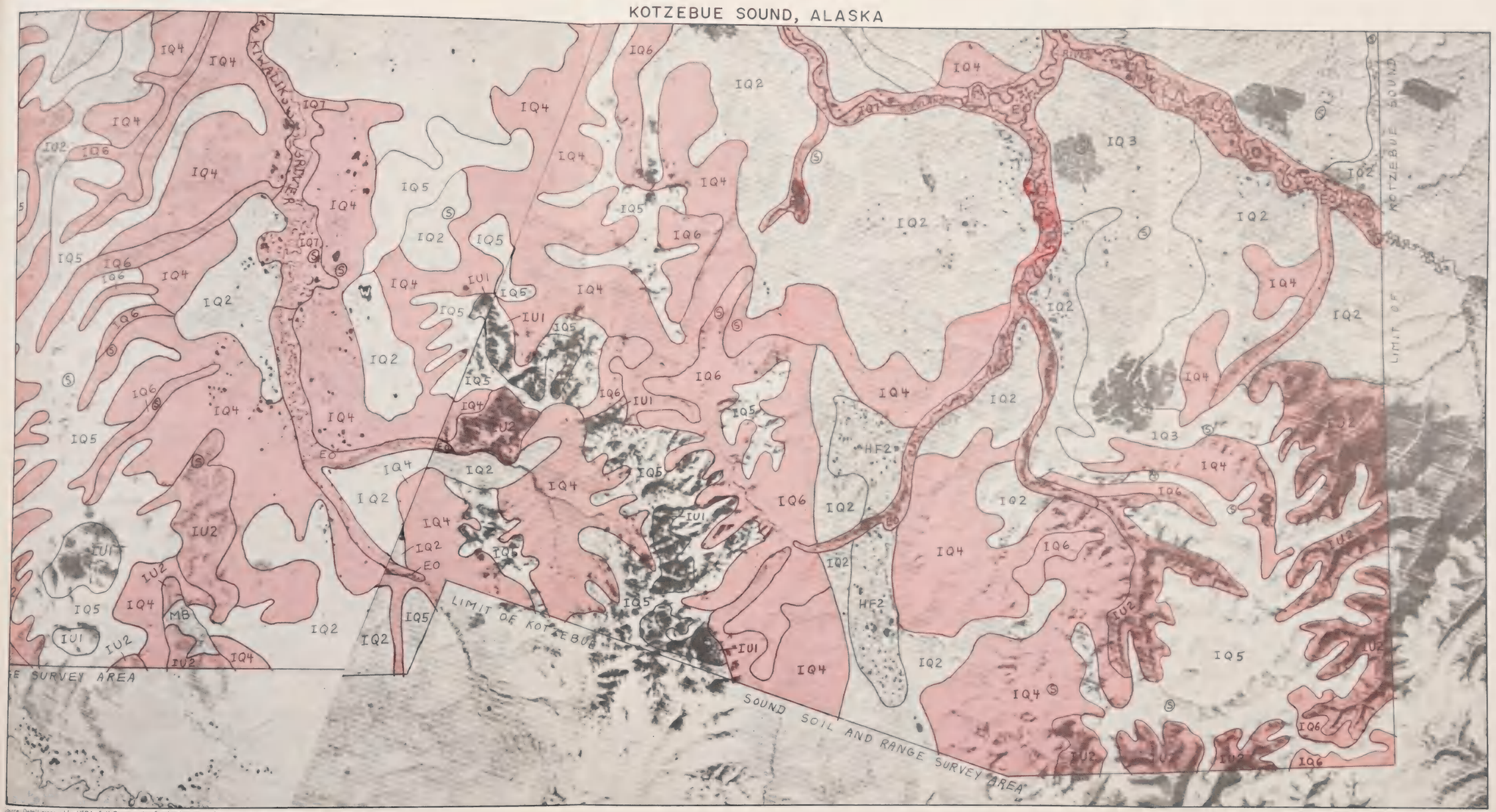
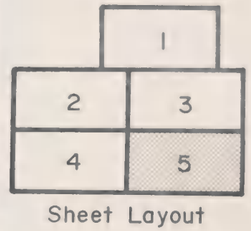
US DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, [illegible] PORTLAND, OR 1977

5 0 5 10 MILES

SCALE 1:250,000

KOTZEBUE SOUND, ALASKA





Sheet Layout

N

AREAS MOST SUITABLE FOR USE BY MOOSE

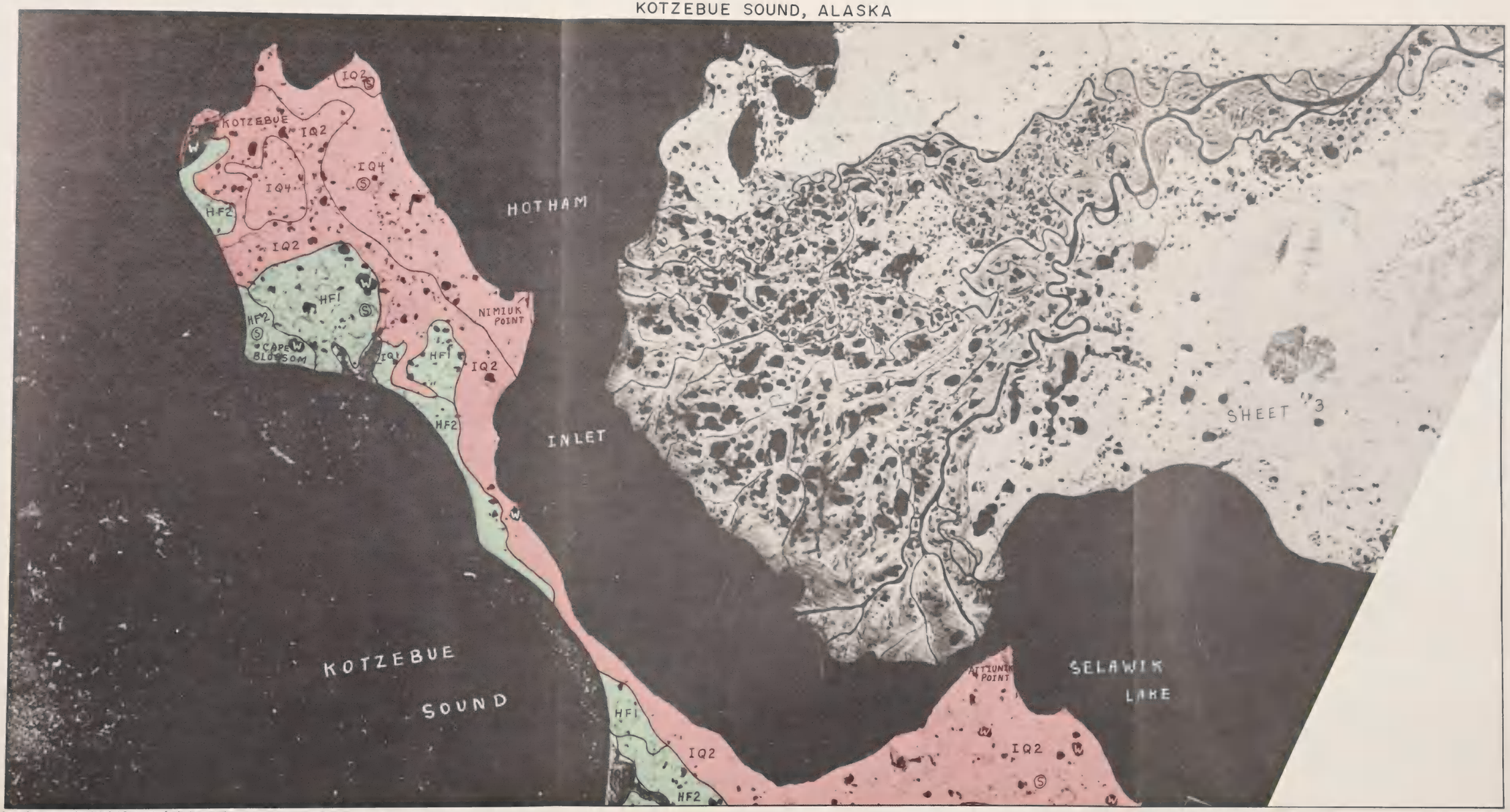
5 0 5 10 MILES

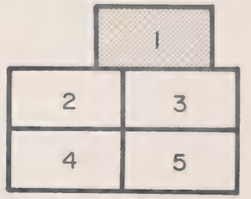
SCALE 1:250,000

Source: Detail prepared by USDA Soil Conservation Service in cooperation with the University of Alaska, Agricultural Experiment Station and Geophysical Institute.

U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE USDA-SCS-PORTLAND, OR 1977

KOTZEBUE SOUND, ALASKA





Sheet Layout

AREAS MOST SUITABLE FOR USE BY MUSKOX

- Winter
- Summer
- Yearlong

5 0 5 10 MILES

SCALE 1:250,000

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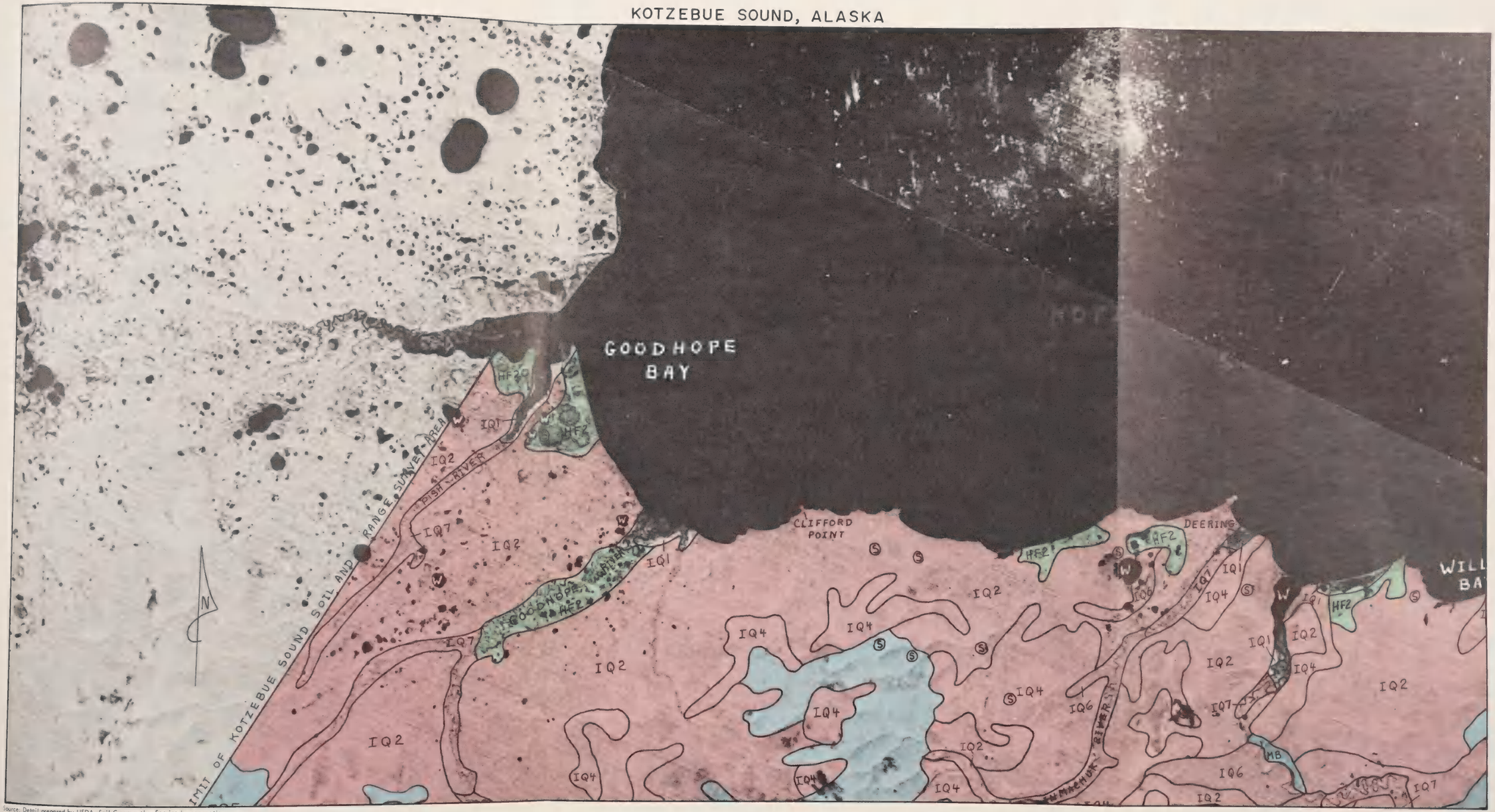
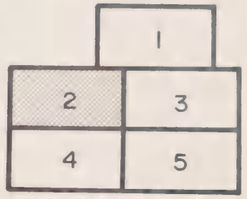
U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE USDA-SCS-PORTLAND, OR 1977

KOTZEBUE SOUND, ALASKA





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5 0 5 10 MILES

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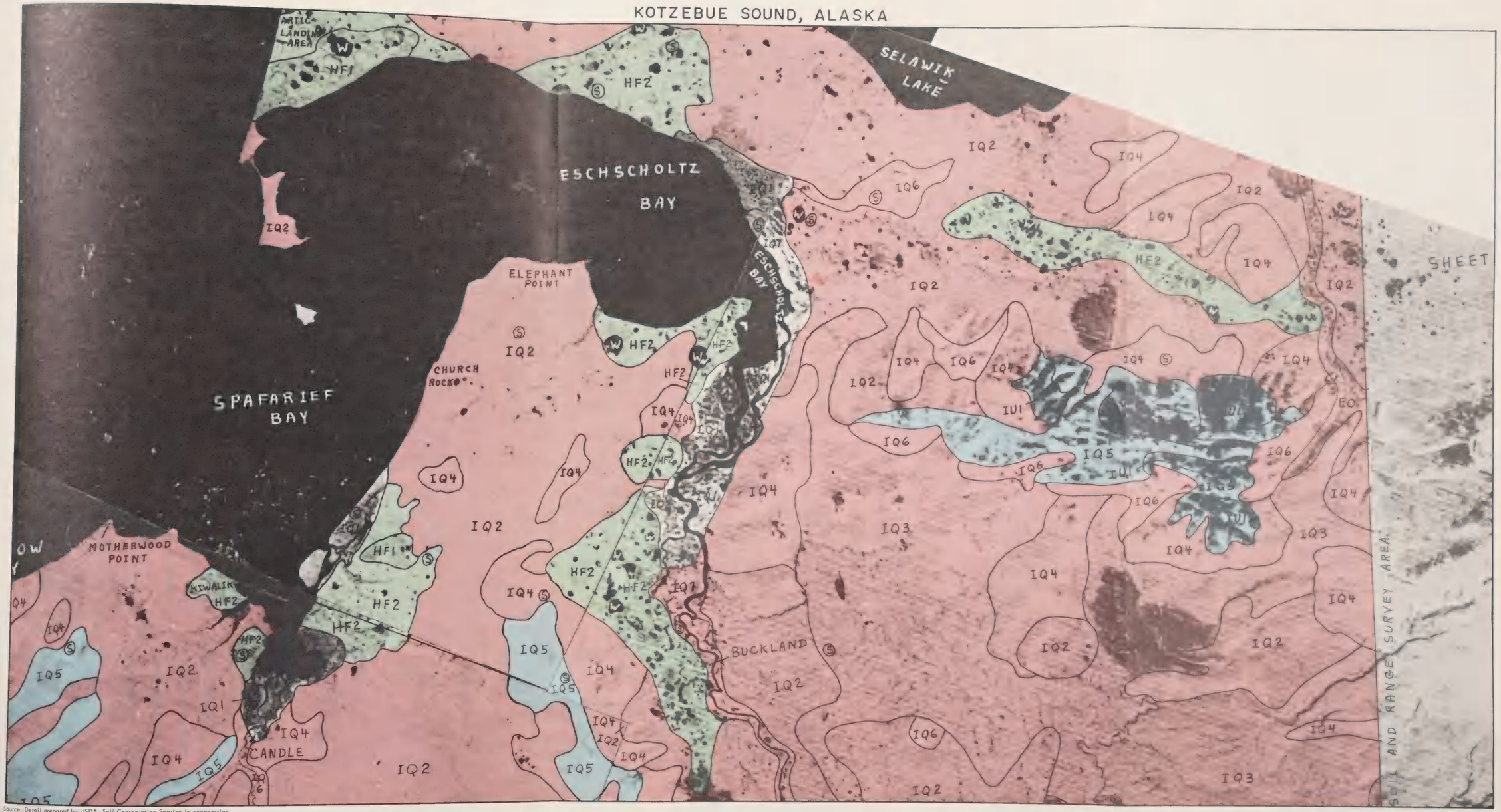
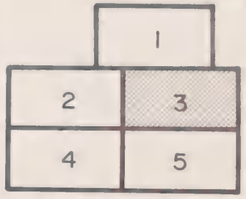
KOTZEBUE SOUND, ALASKA





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AREAS MOST SUITABLE FOR USE BY MUSKOX

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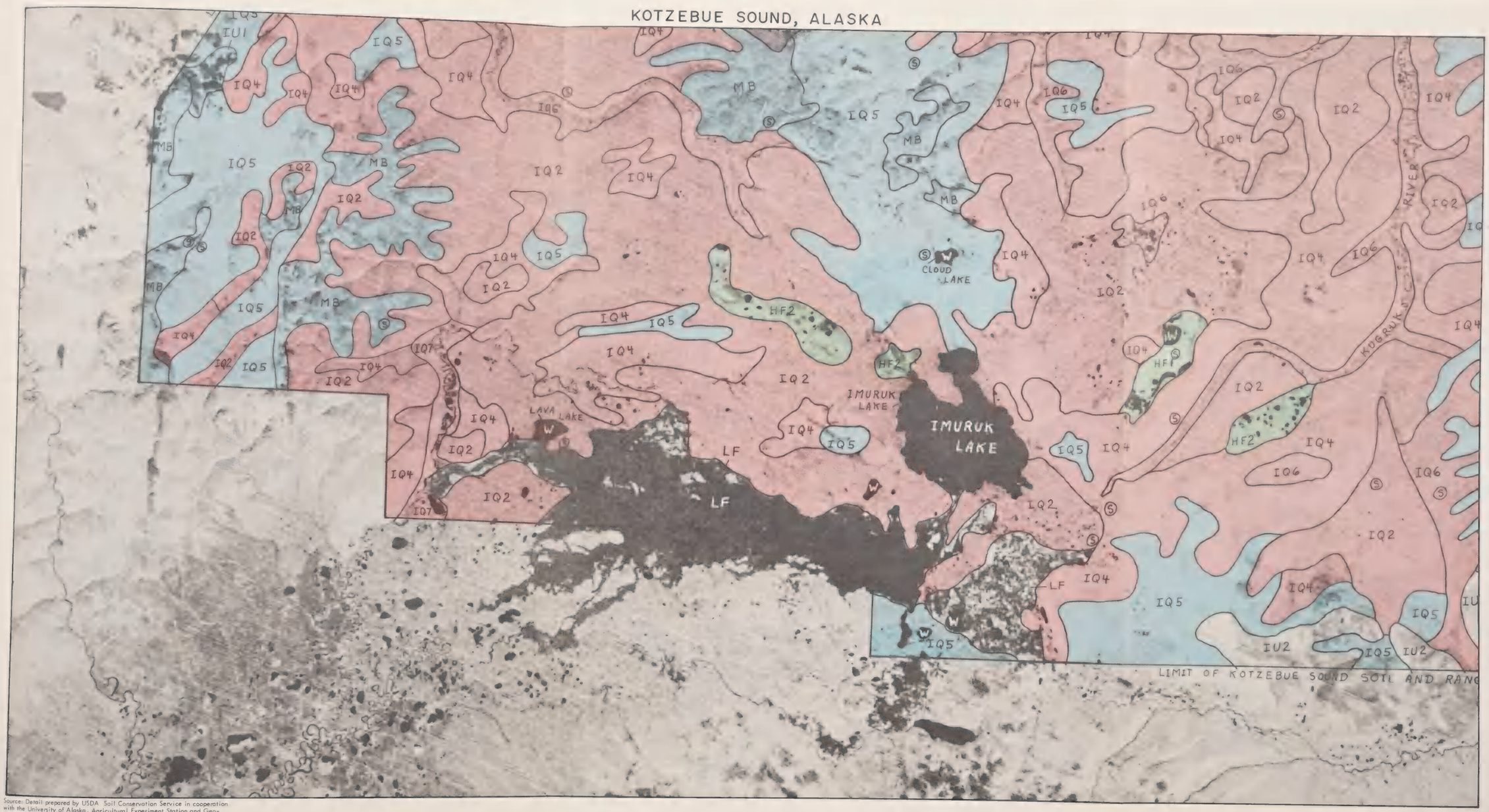

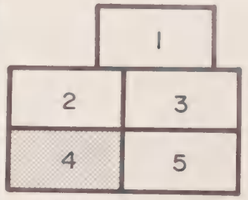

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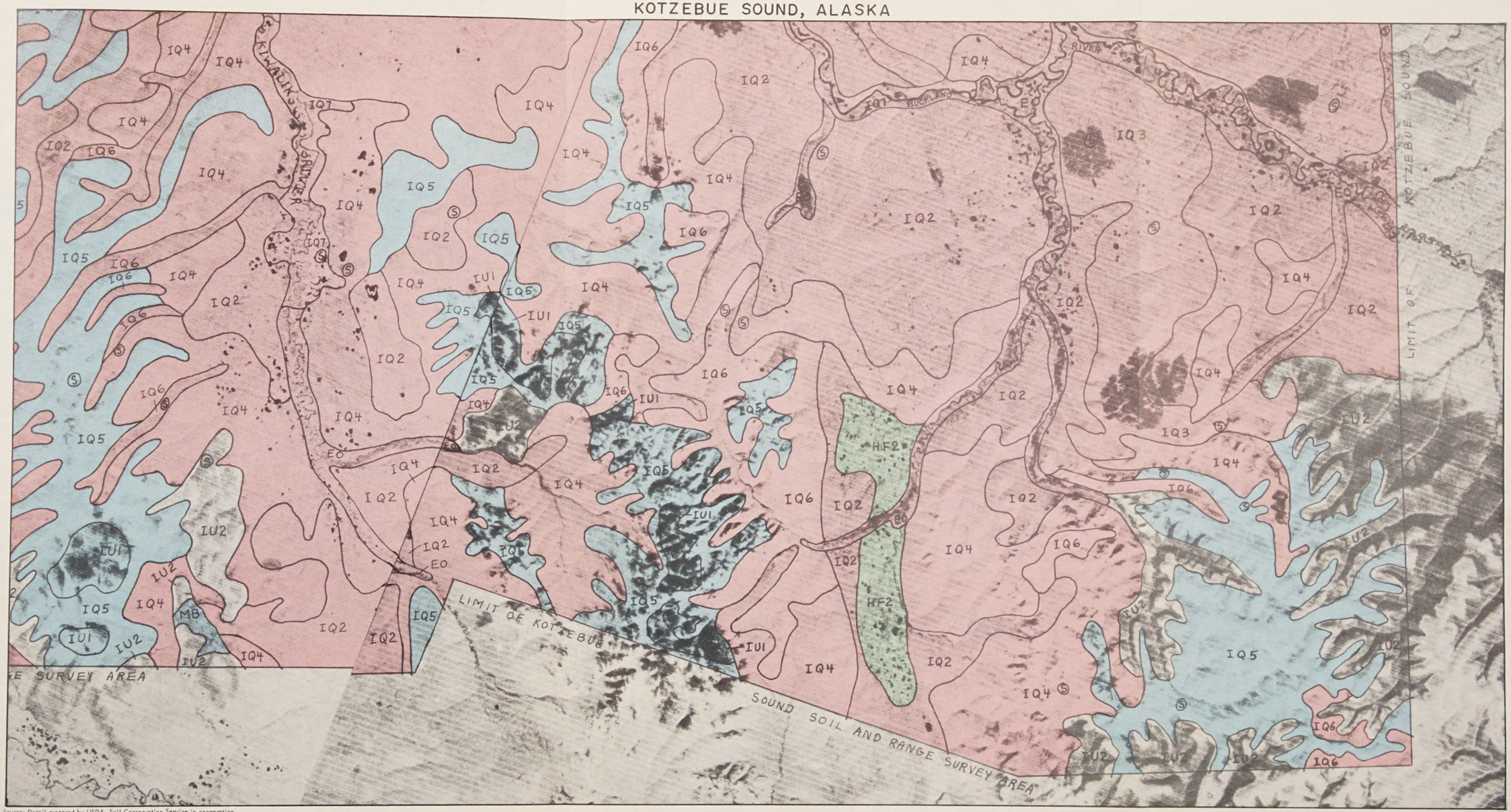

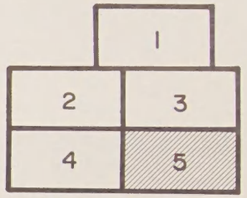

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